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JOURNAL
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THE CHEMICAL SOCIETY.

ABSTRACTS OF PAPERS
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1909. Vol. XCVI. Part II.

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INSTRUCTIONS TO ABSTRACTORS,

GIVING THE

NOMENCLATURE AND SYSTEM OF NOTATION

ADOPTED IN THE ABSTRACTS.

THE object of the abstracts of chemical papers published elsewhere than in the Transactions of the Society is to furnish the Fellows with a concise account of the progress of chemical science from month to month. It must be understood that as the abstracts are prepared for the information of the Fellows in general, they cannot possibly be made so full or so detailed as to obviate on the part of those who are engaged on special investigations the necessity of consulting the original memoirs.

1. Titles of papers must be given literally.

2. Before beginning to write the abstract, the whole of the original paper must be read, in order that a judgment may be formed of its importance and of the scale on which the abstract should be made.

3. In the case of papers dealing with subjects not strictly chemical, the abstract should refer only to matters of chemical interest in the original.

4. The abstract should consist mainly of the expression, in the abstractor's own words, of the substance of the paper.

5. The abstract should be made as short as is consistent with a clear and accurate statement of the author's results.

6. A concise statement showing the general trend of the investigation should be given at the commencement of those abstracts where the nature of the original permits of it.

7. If an abstract of a paper on the same subject, either by the author of the paper abstracted, or by some other author, has already appeared, note should, as a rule, be made of this fact.

8. Matter which has appeared once in the *Abstracts* is not to be abstracted again, a reference being given to the volume in which the abstract may be found.

9. As a rule, details of methods of preparation or analysis, or generally speaking of work, are to be omitted, unless such details are essential to the understanding of the results, or have some independent value. Further, comparatively unimportant compounds, such as the inorganic salts of organic bases or acids, should be mentioned quite shortly. On the other hand, data such as melting and boiling points, sp. gr., specific rotation, &c., must be given in every case unless recorded in earlier papers.

Nomenclature.

10. Employ names such as *sodium chloride, potassium sulphate* for inorganic compounds, and use the terminals *ous* and *ic* only in distinguishing compounds of different orders derived from the same elementary radicle; such, for instance, as mercurous and mercuric chlorides, sulphurous and sulphuric acids.

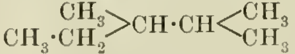
11. Term compounds of metallic radicles with the OH-group *hydroxides* and not hydrates, the name hydrate being reserved for compounds supposed to contain water of combination or crystallisation.

12. Term salts containing an amount of metal equivalent to the displaceable hydrogen of the acid, *normal* and not neutral salts, and assign names such as sodium hydrogen sulphate, disodium hydrogen phosphate, &c., to the acid salts. Basic salts as a rule are best designated merely by their *formulæ*.

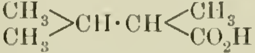
13. Names in common use for oxides should be employed, for example: NO, nitric oxide; CO_2, carbon dioxide; P_4O_{10}, phosphoric oxide; As_4O_6, arsenious oxide; Fe_2O_3, ferric oxide.

14. In open chain compounds, Greek letters must be used to indicate the position of a substituent, the letter α being assigned to the first carbon atom in the formula, except in the case of CN and CO_2H, for example, $CH_3{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2I$ α-iodobutane, $CH_3{\cdot}CH_2{\cdot}CH_2{\cdot}CN$ α-cyanopropane.

15. Isomeric open chain compounds are most conveniently represented as substitution derivatives of the longest carbon chain in the formula; for example,



$$\begin{matrix}CH_3\\CH_3{\cdot}CH_2\end{matrix}\!>\!CH{\cdot}CH\!<\!\begin{matrix}CH_3\\CH_3\end{matrix} \text{ or } CH_3{\cdot}CH_2{\cdot}CHMe{\cdot}CHMe{\cdot}CH_3$$

should be termed βγ-dimethylpentane, not methylethyl*iso*propylmethane, and  $\begin{matrix}CH_3\\CH_3\end{matrix}\!>\!CH{\cdot}CH\!<\!\begin{matrix}CH_3\\CO_2H\end{matrix}$ or $CH_3{\cdot}CHMe{\cdot}CHMe{\cdot}CO_2H$ should be termed αβ-dimethylbutyric acid, not αββ-trimethylpropionic, or α-methyl*iso*valeric, or methyl*iso*propylacetic acid.

16. Use names such as methane, ethane, &c., for the normal paraffins or hydrocarbons of the C_nH_{2n+2} series of the form $CH_3{\cdot}[CH_2]_5{\cdot}CH_3$, &c. Term the hydrocarbons C_2H_4 and C_2H_2 ethylene and acetylene respectively (not ethene and ethine). Homologues of the ethylene series are to be indicated by the suffix *-ene*, and those of the acetylene series, wherever possible, by *-inene*. Adopt the name allene for the hydrocarbon $CH_2{:}C{:}CH_2$.

17. Distinguish all hydroxyl derivatives of hydrocarbons by names ending in *ol*. Alcohols should be spoken of as mono-, di-, tri-, or n-hydric, according to the number of OH-groups. Compounds which are not alcohols, but for which names ending in *ol* have been used, are to be represented by names ending in *ole*, if a systematic name cannot be given, thus anisole not anisol, indole not indol. Compounds such as MeONa, EtONa, &c., should be termed sodium methoxide, sodium ethoxide, &c.

18. The radicles indicated in the name of a compound are to be

given in the order fluoro-, chloro-, bromo-, iodo-, nitro-, nitroso-, amino-, imino-, cyano-, thiocyano-, hydroxy-, keto-.

19. Compounds analogous to the acids of the lactic series containing the OH-group should be termed *hydroxy*-derivatives, and not oxy-derivatives; for example, hydroxyacetic and not oxyacetic acid. Compounds containing the analogous groups OEt, OPh, OAc, &c., should in like manner be termed ethoxy-, phenoxy-, acetoxy- derivatives. Thus α-ethoxypropionic acid, $OEt\cdot CHMe\cdot CO_2H$, instead of ethyl-lactic acid; 3:4-diethoxybenzoic acid, $(OEt)_2C_6H_3\cdot CO_2H$, instead of diethylprotocatechuic acid; and α-acetoxypropionic acid, $OAc\cdot CHMe\cdot CO_2H$, instead of acetyl-lactic acid. Terms such as diethylprotocatechuic acid should be understood to mean a compound formed by the displacement of hydrogen atoms in the hydrocarbon radicle of protocatechuic acid by ethyl, thus, $C_6HEt_2(OH)_2\cdot CO_2H$, and not $C_6H_3(OEt)_2\cdot CO_2H$, just as dibromoprotocatechuic acid is understood to be the name of a compound of the formula $C_6HBr_2(OH)_2\cdot CO_2H$.

20. The term *ether* should be restricted to the oxides of hydrocarbon radicles and their derivatives, and the esters (so-called compound ethers or ethereal salts) should be represented by names similar to those given to metallic salts.

21. When a substituent is one of the groups NH_2, NHR, NR_2, NH or NR, its name should end in *ino*; for example, β-aminopropionic acid, $NH_2\cdot CH_2\cdot CH_2\cdot CO_2H$, β-anilino-acrylic acid, $NHPh\cdot CH\colon CH\cdot CO_2H$, α-iminopropionic acid, $NH\colon CMe\cdot CO_2H$.

22. Compounds of the radicle SO_3H should, whenever possible, be termed sulphonic acids, or failing this, sulpho-compounds; for example, benzenesulphonic acid, sulphobenzoic acid.

23. Basic substances should invariably be indicated by names ending in *ine*, as aniline instead of anilin, the termination *in* being restricted to certain neutral compounds, viz., glycerides, glucosides, bitter principles, and proteins, such as palmitin, amygdalin, albumin. The compounds of basic substances with hydrogen chloride, bromide or iodide should always receive names ending in *ide* and not *ate*, as morphine hydrochloride and not morphine hydrochlorate.

24. The Collective Index, 3rd decade (1893–1902) should be adopted as the standard of reference on questions of nomenclature not provided for in the preceding sections.

Notation.

25. In empirical formulæ the elements are to be given in the order C, H, O, N, Cl, Br, I, F, S, P, and the remainder alphabetically.

26. Equations should be omitted unless essential to the understanding of the results; as a rule, they should not be written on a separate line, but should "run on" with the text.

27. To economise space, it is desirable:

(a) That *dots* should be used instead of *dashes* in connecting contiguous symbols or radicles, whenever this does not interfere with the clearness of the formula.

(b) That formulæ should be shortened by the judicious employment of the symbols Me for CH_3, Et for C_2H_5, Pr^{α} for $CH_2{\cdot}CH_2{\cdot}CH_3$, Pr^{β} for $CH(CH_3)_2$, Ph for C_6H_5, Py for C_5H_4N, Ac for $CO{\cdot}CH_3$, and Bz for $CO{\cdot}C_6H_5$.

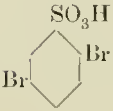
(c) That formulæ should be written *in one line* whenever this can be done without obscuring their meaning.

28. In representing the constitution of benzene derivatives, the relative positions of the radicles in the symbol of benzene should be indicated by numerals, instead of by means of the hexagon formula.

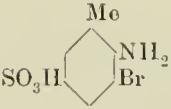
(a) The abbreviations *o*-, *m*-, and *p*-, should be used in place of 1 : 2- or ortho-, 1 : 3- or meta-, and 1 : 4- or para.

(b) In numbering positions in the case of substitution derivatives of phenol, aniline, benzonitrile, benzoic acid, benzenesulphonic acid, benzaldehyde, and toluene, the characteristic radicle of each of these parent substances is to be regarded as in position 1 (compare Collective Index).

(c) Names of substitution derivatives should be given in such a way that the position of the substituent is indicated by a numeral prefixed ; for example :—

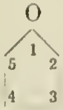


is 2 : 5-dibromobenzenesulphonic acid ;

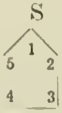


is 3-bromo-*o*-toluidine-5 sulphonic acid.

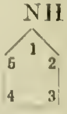
29. In representing the constitution of derivatives of other "closed chain" hydrocarbons, graphic formulæ should not be employed, but the system of numbering positions indicated in Richter's *Lexikon der Kohlenstoff-Verbindungen* (2nd edition, 1899, pp. 16—26) should be used, of which the following schemes may be regarded as typical :—



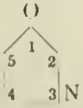
Furan.



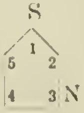
Thiophen.



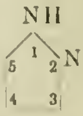
Pyrrole.



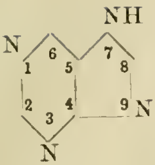
Oxazole.



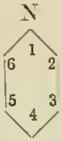
Thiazole.



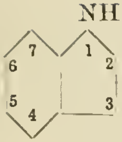
Pyrazole.



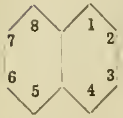
Purine.*



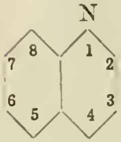
Pyridine.



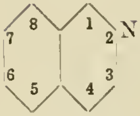
Indole.



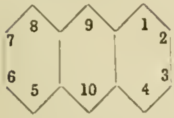
Naphthalene.



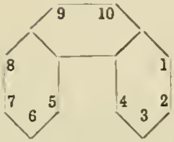
Quinoline.



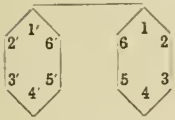
*iso*Quinoline.



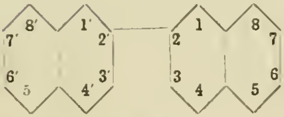
Anthracene.



Phenanthrene.



Diphenyl.



ββ-Dinaphthyl.

Manuscript.

30. In view of the difficulty of dealing with MSS. of widely varying sizes, abstracts cannot be accepted unless written on quarto paper (10 × 8 in.).

31. Not more than one abstract must appear on a sheet.

32. When an abstract exceeds a sheet in length, the sheets must be fastened together by means of gum at the top left-hand corner.

33. The name of the abstractor must be written diagonally at the top left-hand corner of the first sheet of the abstract.

Proofs.

34. Abstractors are expected to read and correct proofs carefully, and to check all formulæ and figures against MSS.

35. All proofs, however small, must be returned to the Sub-Editor not later than 24 hours after receipt from the printers.

⁂ The Editor's decision, in all matters connected with the Abstracts, must be considered final.

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* This numbering, proposed originally by E. Fischer, is adopted in the text of the *Lexikon.*

JOURNALS FROM WHICH ABSTRACTS ARE MADE.

All references to Journals should give the abbreviated title, the year of publication, the series, the volume and the page; thus *Ber.* 1901, **34**, 2455; *Bull. Soc. chim.* 1901, [iii], **25**, 794, *Gazzetta* 1901, **31**, i, 554.

Abbreviated Title.	Journal.
Amer. Chem. J.	American Chemical Journal.
Amer. J. Pharm.	American Journal of Pharmacy.
Amer. J. Physiol.	American Journal of Physiology.
Amer. J. Sci.	American Journal of Science.
Anal. Fis. Quim.	Anales de la Sociedad Española Fisica y Quimica.
Analyst	The Analyst.
Annalen	Justus Liebig's Annalen der Chemie.
Ann. Chim. anal.	Annales de Chimie analytique appliquée à l'Industrie, à l'Agriculture, à la Pharmacie et à la Biologie.
Ann. Chim. Phys.	Annales de Chimie et de Physique.
Ann. Falsif.	Annales des Falsifications.
Ann. Inst. Pasteur	Annales de l'Institut Pasteur.
Ann. Physik	Annalen der Physik.
Ann. sci. Univ. Jassy	Annales scientifiques de l'Université de Jassy.
Arch. expt. Path. Pharm.	Archiv für experimentelle Pathologie und Pharmakologie.
Arch. Hygiene	Archiv für Hygiene.
Arch. Néerland.	Archives Néerlandaises des sciences exactes et naturelles.
Arch. Pharm.	Archiv der Pharmazie.
Arch. Sci. phys. nat.	Archives des Sciences physiques et naturelles.
Arkiv Kem. Min. Geol.	Arkiv för Kemi, Mineralogi och Geologi.
Atti R. Accad. Sci. Torino.	Atti della Reale Accademia delle Scienze di Torino.
Atti R. Accad. Lincei	Atti della Reale Accademia dei Lincei.
Ber.	Berichte der Deutschen chemischen Gesellschaft.
Ber. Deut. bot. Ges.	Berichte der Deutschen botanischen Gesellschaft.
Ber. Deut. pharm. Ges.	Berichte der Deutschen pharmazeutischen Gesellschaft.
Ber. Deut. physikal. Ges	Berichte der Deutschen physikalischen Gesellschaft.
* *Bied. Zentr.*	Biedermann's Zentralblatt für Agrikulturchemie und rationellen Landwirtschafts-Betrieb.
Bio-Chem. J.	The Bio-Chemical Journal.
Biochem. Zeitsch.	Biochemische Zeitschrift.
Boll. chim. farm.	Bollettino chimico farmaceutico.
Bull. Acad. roy. Belg.	Académie royale de Belgique—Bulletin de la Classe des Sciences.
Bull. Acad. Sci. Cracow	Bulletin international de l'Académie des Sciences de Cracovie.
Bull. Acad. Sci., St. Pétersbourg.	Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg.
Bull. Assoc. chim. Sucr. Dist.	Bulletin de l'Association des chimistes de Sucrerie et de Distillerie.
Bull. Coll. Agr. Tōkyō	Bulletin of the College of Agriculture, Imperial University, Tōkyō.
Bull. Geol. Soc. Amer.	Bulletin of the Geological Society of America.
Bull. Imp. Inst.	Bulletin of the Imperial Institute.
Bull. Soc. chim.	Bulletin de la Société chimique de France.
Bull. Soc. chim. Belg.	Bulletin de la Société chimique de Belgique.
Bull. Soc. franç. Min.	Bulletin de la Société française de Minéralogie.
Bull. Soc. ind. Mulhouse	Bulletin de la Société industrielle de Mulhouse.
Centr. Bakt. Par.	Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten.
Centr. Min.	Centralblatt für Mineralogie, Geologie und Palaeontologie.
* *Chem. Zentr.*	Chemisches Zentralblatt.
Chem. News	Chemical News.

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* Abstracts from the *Zentralblatt* are made only in the case of papers published in journals other than those included in this list.

ABBREVIATED TITLE.	JOURNAL.
Chem. Rev. Fett-Harz-Ind.	Chemische Revue über die Fett- und Harz-Industrie.
Chem. Weekblad	Chemisch Weekblad.
Chem. Zeit.	Chemiker Zeitung.
Compt. rend.	Comptes rendus hebdomadaires des Séances de l'Académie des Sciences.
Exper. Stat. Record	Experiment Station Record.
Gazzetta	Gazzetta chimica italiana.
Geol. Mag.	Geological Magazine.
Jahrb. Min.	Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie.
Jahrb. Min. Beil.-Bd.	Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie. Beilage-Band.
Jahrb. Radioaktiv. Elektronik.	Jahrbuch der Radioaktivität und Elektronik.
J. Amer. Chem. Soc.	Journal of the American Chemical Society.
J. Biol. Chem.	Journal of Biological Chemistry, New York.
J. Chim. phys.	Journal de Chimie physique.
J. Geol.	Journal of Geology.
J. Hygiene	Journal of Hygiene.
J. Inst. Brewing	Journal of the Institute of Brewing.
J. Landw.	Journal für Landwirtschaft.
J. Med. Research	Journal of Medical Research.
J. Path. Bact.	Journal of Pathology and Bacteriology.
J. Pharm. Chim.	Journal de Pharmacie et de Chimie.
J. Physical Chem.	Journal of Physical Chemistry.
J. Physiol.	Journal of Physiology.
J. pr. Chem.	Journal für praktische Chemie.
J. Roy. Agric. Soc.	Journal of the Royal Agricultural Society.
J. Roy. Soc. New South Wales.	Journal of the Royal Society of New South Wales.
J. Russ. Phys. Chem. Soc.	Journal of the Physical and Chemical Society of Russia.
J. Soc. Chem. Ind.	Journal of the Society of Chemical Industry.
J. Soc. Dyers	Journal of the Society of Dyers and Colourists.
K. Svenska Vet-Akad. Handl.	Kongl. Svenska Vetenskaps-Akademiens Handlingar.
Lancet.	The Lancet.
Landw. Versuchs-Stat.	Die landwirtschaftlichen Versuchs-Stationen.
Le Radium	Le Radium.
Mem. Accad. Sci. Torino	Memorie della Reale Accademia delle Scienze di Torino.
Mem. Coll. Sci. Eng. Kyōtō.	Memoirs of the College of Science and Engineering, Kyōtō Imperial University.
Mem. Manchester Phil. Soc.	Memoirs and Proceedings of the Manchester Literary and Philosophical Society.
Metallurgie	Metallurgie.
Milch. Zentr.	Milchwirtschaftliches Zentralblatt.
Min. Mag.	Mineralogical Magazine and Journal of the Mineralogical Society.
Monatsh.	Monatshefte für Chemie und verwandte Theile anderer Wissenschaften.
Nuovo Cim.	Il Nuovo Cimento.
Pflüger's Archiv.	Archiv für die gesammte Physiologie des Menschen und der Thiere.
Pharm. J.	Pharmaceutical Journal.
Pharm. Rev.	Pharmaceutical Review.
Pharm. Weekblad	Pharmaceutisch Weekblad.
Pharm. Zeit.	Pharmazeutische Zeitung.
Pharm. Zentr-h.	Pharmazeutische Zentralhalle.
Philippine J. Sci.	Philippine Journal of Science.
Phil. Mag.	Philosophical Magazine (The London, Edinburgh and Dublin).

JOURNALS FROM WHICH ABSTRACTS ARE MADE.

ABBREVIATED TITLE.	JOURNAL.
Phil. Trans.	Philosophical Transactions of the Royal Society of London.
Physikal. Zeitsch.	Physikalische Zeitschrift.
Proc. Amer. Physiol. Soc.	Proceedings of the American Physiological Society.
Proc. Camb. Phil. Soc.	Proceedings of the Cambridge Philosophical Society.
Proc. K. Akad. Wetensch. Amsterdam.	Koninklijke Akademie van Wetenschappen te Amsterdam. Proceedings (English version).
Proc. Phil. Soc. Glasgow	Proceedings of the Glasgow Philosophical Society.
Proc. Physiol. Soc.	Proceedings of the Physiological Society.
Proc. Roy. Soc.	Proceedings of the Royal Society.
Proc. Roy. Soc. Edin.	Proceedings of the Royal Society of Edinburgh.
Quart. J. exp. Physiol.	Quarterly Journal of experimental Physiology.
Quart. J. Geol. Soc.	Quarterly Journal of the Geological Society.
Rec. trav. chim.	Receuil des travaux chimiques des Pays-Bas et de la Belgique.
Rend. Accad. Sci. Fis. Mat. Napoli.	Rendiconto dell' Accademia delle Scienze Fisiche e Matematiche-Napoli.
Rev. de Métallurgie	Revue de Métallurgie.
Sci. Proc. Roy. Dubl. Soc.	Scientific Proceedings of the Royal Dublin Society.
Sci. Trans. Roy. Dubl. Soc.	Scientific Transactions of the Royal Dublin Society.
Sitzungsber. K. Akad. Wiss. Berlin.	Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin.
Sitzungsber. K. Akad. München.	Sitzungsberichte der königlich bayerischen Akademie der Wissenschaften zu München.
Trans. Amer. Electrochem. Soc.	Transactions of the American Electrochemical Society.
Trans. Amer. Inst. Mining Eng.	Transactions of the American Institute of Mining Engineers.
Trans. Faraday Soc.	Transactions of the Faraday Society.
Trans. Nova Scotia Inst. Sci.	Transactions of the Nova Scotia Institute of Science.
Trans. Path. Soc.	Transactions of the Pathological Society.
Trans. Roy. Soc. Canada	Transactions of the Royal Society of Canada.
Trans. Roy. Soc. Edin.	Transactions of the Royal Society of Edinburgh.
Trans. Roy. Irish Acad.	Transactions of the Royal Irish Academy.
Tsch. Min. Mitt.	Tschermak's Mineralogische Mitteilungen.
U.S.A. Dept. Agric. Bull.	Bulletins of the Department of Agriculture, U.S.A.
U.S.A. Dept. Agric. Rep.	Reports of the Department of Agriculture, U.S.A.
Verh. Ges. deut. Naturforsch. Aerzte	Verhandlung der Gesellschaft deutscher Naturforscher und Aerzte.
Wiss. Abhandl. Phys.-Tech. Reichsanstalt.	Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt.
Zeitsch. anal. Chem.	Zeitschrift für analytische Chemie.
Zeitsch. angew. Chem.	Zeitschrift für angewandte Chemie.
Zeitsch. anorg. Chem.	Zeitschrift für anorganische Chemie.
Zeitsch. Biol.	Zeitschrift für Biologie.
Zeitsch. Chem. Ind. Kolloide.	Zeitschrift für Chemie und Industrie der Kolloide.
Zeitsch. Elektrochem.	Zeitschrift für Elektrochemie.
Zeitsch. Farb.-Ind.	Zeitschrift für Farben-Industrie.
Zeitsch. Kryst. Min.	Zeitschrift für Krystallographie und Mineralogie.
Zeitsch. Nahr. Genussm.	Zeitschrift für Untersuchung der Nahrungs- und Genussmittel.
Zeitsch. öffentl. Chem.	Zeitschrift für öffentliche Chemie.
Zeitsch. physikal. Chem.	Zeitschrift für physikalische Chemie, Stochiometrie und Verwandtschaftslehre.
Zeitsch. physiol. Chem.	Hoppe-Seyler's Zeitschrift für physiologische Chemie
Zeitsch. prakt. Geol.	Zeitschrift für praktische Geologie.
Zeitsch. Ver. deut. Zuckerind.	Zeitschrift des Vereins der deutschen Zucker-Industrie.
Zeitsch. wiss. Photochem.	Zeitschrift für wissenschaftliche Photographie, Photophysik und Photochemie.
Zeitsch. Zuckerind. Böhm.	Zeitschrift für Zuckerindustrie in Böhmen.

JOURNAL

OF

THE CHEMICAL SOCIETY.

ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

General Relationship between Volume Contraction and the Three Usual Forms of the Refraction Formula in the Case of Mixtures of Liquids. V. F. Hess (*Ann. Physik*, 1908, [iv], 27, 589–625).—When a volume v_1 of a liquid of density D_1 is mixed with a volume v_2 of a liquid of density D_2, the contraction, c, is given by the formula $c=(D-D_v)/D$, where $D_v=(v_1D_1+v_2D_2)/(v_1+v_2)$ is the density which the mixture would have if no contraction took place, and D is the observed density. It is now shown, from the available experimental data, that the relation holds:

$$(R-R_v)/R=q.(D-D_v)/D=qc,$$

where R_v denotes the refraction which the mixture would have if no contraction took place on mixing, R is the actual refractive power of the mixture, and q is a constant for any one binary mixture. The relation holds when the refraction is expressed in any of the three usual forms: n^2-1 (Newton), $n-1$ (Beer, Gladstone), or $(n^2-1)/(n^2+2)$ (Lorenz and Lorentz).

From this relationship, the refraction or the refractive index of mixtures of the components in any proportion can be calculated when the composition of the mixture, the refractive indices of the pure components, as well as q and c, are known, and, similarly, the composition of a mixture can be calculated when all the other factors are known.

The relationship holds, also, almost independently of the temperature and of the wave-length of light used in measuring the refractive indices. G. S.

The So-called Asymmetry Product. Emil Bose (*Physikal. Zeitsch.*, 1908, 9, 860—863).—A theoretical discussion of the significance of the asymmetry product as determining the optical rotatory power. The fact that Guye's theory, according to which the masses of the groups attached to the asymmetric carbon atom are the determining group factors, is inconsistent with experimental observations, does not preclude the possibility that the optical rotatory power may be determined by an asymmetric product. The fact that the rotatory power varies with the temperature and with the wave-length indicates that these factors must be taken into account in any satisfactory explanation of the observed facts. Each atom or group will be characterised by a specific variation of the determining factor with the temperature and the wave-length of the light, and a possible method of ascertaining the values of the group factors from experimental observations is outlined. H. M. D.

Spectroscopic Experiments with Small Quantities of Liquids. Julius Donau (*Monatsh.*, 1908, 29, 959—963).—Data are recorded which show that measurements of the wave-lengths of the bands of the absorption spectra of solutions can be made with very small quantities of liquid contained in capillary tubes. Aqueous solutions of potassium permanganate, neodymium and praseodymium nitrate, and erbium chloride were examined. The arrangement described is suitable for the detection of very small quantities of these substances. H. M. D.

Production of Line Spectra. Eugen Goldstein (*Ann. Physik*, 1908, [iv], 27, 773—796).—A method for the production of well-developed line spectra of certain metals and of all chemically reactive non-metals is described. Finely-powdered salts are introduced into a cylindrical discharge tube until the anode at the lower end of the tube is completely covered, and the electrodes connected with an induction coil. Under these circumstances, the discharge does not take place along the shortest path, but between the column of salt and the walls of the discharge tube; an emission spectrum is thereby obtained which can be maintained in many cases for several hours.

The spectra of the alkali metals, which are obtained by introducing alkali halides into the discharge tube, are remarkably well-developed. Whereas, for instance, the Bunsen flame spectrum only shows the double red and violet lines of potassium, it is possible to recognise seventeen other lines in the spectrum produced in the above way.

By placing suitable condensers in parallel with the discharge tubes containing the alkali metal halides, well-developed spectra of the halogens are obtained. By using calcium sulphide or potassium sulphate, the line spectrum of sulphur is produced. In a similar way, emission spectra of tellurium, selenium, phosphorus, arsenic, and antimony can be obtained by introducing the sodium salts of the corresponding highest oxygen acids into the discharge tubes.

The halogen salts of the alkaline earth metals give rise, in general, both with and without condenser, to the spectra of the halogens. If, however, the discharge tubes are made very narrow at the anode end, the spectra of the metals are obtained.

Various modifications of discharge tubes are described, by means of which the spectra can be most conveniently obtained. H. M. D.

Infra-red Line Spectra. I. (Normal Wave-lengths up to 27,000 Ångstrom Units.) FRIEDRICH PASCHEN (*Ann. Physik*, 1908, [iv], 27, 537—570).—The measurements were made with a special form of grating spectro-bolometer. The methods of measurement are fully described. The main object of the investigation was to determine standard wave-lengths in the infra-red, and, except for the measurements with the alkali metals, the results are accurate to within one or two Ångstrom units.

Measurements have been made in Geissler tubes with helium, argon, hydrogen, and oxygen; with lithium, sodium, and potassium in the electric arc with carbon poles, and also with mercury. In the case of helium, new lines of wave-lengths 12,784·6, 12,792·8, 18,684·2, and 18,694·2 were discovered, which belong to two new series. Similarly, lines belonging to a new series were discovered in the case of hydrogen. The existence of this new series, as well as the series to which the new lines of helium belong, had been foreseen by Ritz from the data referring to series previously known. Satisfactory results were obtained for some mercury lines, and these are particularly suitable as standards. The results with the alkali metals are much less accurate than the others; they were determined in order to test some of the formulæ employed in calculating the wave-lengths of the different members of a series. G. S.

Spectral Analysis of the Glow Light in Different Gases. FRANS HIMSTEDT and H. VON DECHEND (*Physikal. Zeitsch.*, 1908, 9, 852—853).—The authors have made a spectroscopic examination of the luminous glow which accompanies point discharge in gases at atmospheric pressure, and have compared the spectra with those obtained in the action of radium on the same gases. In the case of air and nitrogen, the two spectra are identical, but with hydrogen, carbon monoxide, and carbon dioxide, considerable differences are found.

The point discharge spectra of oxygen, chlorine, and nitrogen are similar to those obtained in spark or Geissler tube discharge.

In the immediate neighbourhood of the discharging points, hydrogen exhibits the secondary hydrogen spectrum. Corresponding with the radiation of negatively-charged particles from the cathode, a second region of emission is found, which gives lines which do not correspond with any known spectrum. The authors attribute this new spectrum to the presence of traces of impurities in the hydrogen.

Hydrogen chloride yields the stronger chlorine lines, and some of the hydrogen lines on a continuous background. Methane gives hydrogen lines and the Swan spectrum; nitric oxide and air, the first banded spectrum of nitrogen. Carbon monoxide and dioxide do not give the same spectrum; the monoxide shows the Swan spectrum and the sharp bands found at the red end of the Geissler tube spectrum, whilst the dioxide yields the sharp lines at the violet end of this spectrum. H. M. D.

Emission Spectra of Certain Elements at High Temperatures. Emanuale Paternò and Arrigo Mazzucchelli (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 428—432).—In the spectrum of sulphur vapour (compare Abstr., 1907, ii, 451) no luminous bands or discontinuity is observable, but photographic reproduction of the spectrum indicates the presence of somewhat broad, but indistinct, bands. The complete or almost complete continuity of the emission spectrum of sulphur is doubtless related to the high density of its vapour, and it cannot be affirmed that distinct bands may not be obtained under reduced pressures.

In the authors' experiments, the heating of the sulphur was effected in quartz test-tubes, under which conditions certain other elements were examined, with the following results. Selenium vapour, which is yellow just above the boiling point, acquires at higher temperatures a red luminosity, increasing in intensity until, just before the quartz softens, it becomes a faint yellow, dazzling white light; the spectrum exhibits numerous, well-defined bands, which shade off towards the red end of the spectrum. The yellow vapour of tellurium, as the temperature is raised, assumes a green appearance, owing to a blue light, which increases in intensity and becomes dazzling at the temperature at which quartz softens; the spectrum exhibits, in greater number than that of selenium, bands which shade off more towards the red, and are not very marked on the luminous background. With phosphorus and arsenic, even at the highest temperature reached, the vapours are almost dark, and the feeble spectra which they yield exhibit no discontinuity or bands; the same is the case with mercury vapour. The emission spectrum of antimony at 1400° is almost continuous, but exhibits several bands.

In no case was a line spectrum observed, such a spectrum probably corresponding with a temperature higher than that at which bands appear. Band spectra are obtained more easily with elements of high atomic weight, which also give greater luminosity.

According to Fredenhagen (Abstr., 1907, ii, 146), discontinuous spectra of vapours are due to polymerisation and depolymerisation occurring during changes of temperature, whilst with an absolutely uniform temperature only continuous spectra are obtained. The phenomena of variable dissociation are not, however, sufficient to determine discontinuous radiation, since, in the quartz tubes employed by the authors, considerable variations of temperature occur, whilst sulphur, phosphorus, and arsenic, the molecules of which are polyatomic and liable to dissociate, seem to give spectra which are either continuous or give only feeble indications of more luminous bands.

T. H. P.

Spectrum of Scandium, and its Relation to Solar Spectra. A. FOWLER (*Phil. Trans.*, 1908, **209**, *A*, 47—70; *Proc. Roy. Soc.*, 1908, **81**, *A*, 335—336).—Most of the results were obtained with a specimen of pure scandium oxide prepared by Sir William Crookes. Only the spectrum obtained with the electric arc was examined, but the conditions were varied so as to give in some cases an approach to the spark spectrum, and in others to the flame spectrum.

The arc spectrum consists of two distinct sets of lines, including both strong and faint lines, which behave very differently in solar spectra. One set are feeble or missing from the arc-flame spectrum, and are strengthened in passing to the arc, the arc in hydrogen, or the spark. They occur as relatively strong lines in the Fraunhofer spectrum, are weakened in the sun-spot spectrum, and occur as high-level lines in the chromosphere. The other set are relatively strong in the arc-flame, are feebly represented in the Fraunhofer spectrum, and do not appear to be present in the spectrum of the chromosphere, but the stronger lines are prominent in sun-spots. There is evidence that the greater part of the scandium absorption in the solar spectrum originates at a higher level than that at which the greater part of the iron absorption is produced.

The flutings in the arc and arc-flame spectra are absent when the arc is passed in hydrogen, and are probably due to scandium oxide.

G. S.

Absorption Spectra of Some Compounds of Pyridine. JOHN E. PURVIS (*Proc. Camb. Phil. Soc.*, 1908, **14**, 568—577. Compare Abstr., 1908, ii, 745; Baker and Baly, Trans., 1907, **91**, 1122).—The absorption curves of 2:3:5-trichloro- and 3:4:5-trichloro-pyridine are very similar in form, but the absorption band of the former compound is nearer the red end of the spectrum than that of the isomeride, and is of greater persistency. The positions of the bands expressed in oscillation frequencies are 3580 for the 2:3:5-compound and 3650 for the 3:4:5-isomeride.

Tetrachloro-2-aminopyridine, tetrachloro-4-aminopyridine, and pentachloropyridine give similar absorption curves, but the absorption band of the first compound is displaced more, and that of its isomeride less, towards the red end of the spectrum than that of pentachloropyridine; the positions of the bands expressed in oscillation frequencies, are: tetrachloro-2-aminopyridine, 3050; tetrachloro-4-aminopyridine, 3550, and pentachloropyridine, 3400. The persistency of the band of pentachloropyridine is greater than that of the 2-amino-compound, and considerably greater than that of the 4-amino-compound; in fact, the band of the latter compound has almost disappeared.

The absorption curves indicate that the relative positions and persistencies of the bands are influenced by the nature and spacial positions of the atoms or groups introduced into the nucleus.

W. H. G.

Luminescence Phenomena of Blue Fluorspar. EDGAR MEYER (*Ber. deut. physikal. Ges.*, 1908, **6**, 643—657; *Physikal. Zeitsch.*, 1908, **9**, 810—816).—Experiments are described the object of which was to determine the nature of the luminescence phenomena exhibited by certain blue fluorspars after exposure to light. During the decay of the thermo-luminescence, and for a considerable time after the disappearance of the visible effect, the emission of ultra-violet photochemically active rays can be detected. The intensity of this radiation diminishes gradually, but in the case of fluorspar from Wölsendorf, in Bavaria, the ultra-violet radiation could still be detected by the photographic action after the substance had been kept in the dark for one hundred and fifty days.

If the fluorspars are heated at 230—260°, the luminescent properties are not developed by exposure to diffused daylight or to an arc light; on the other hand, they respond to the light from electric sparks or a mercury lamp even when heated to a bright red heat.

The experiments also show that the intensity of the luminescent radiation increases with the length of the period of exposure to the primary radiation when this period is small. Above a certain limit, the period of exposure has, however, no influence on the emitted radiation. There appears to be no connexion between the effect examined by the author and the photo-electric activity. H. M. D.

Actinic Electrolysis. Carl George Schluederberg (*J. Physical Chem.*, 1908, **12**, 574—631).—A number of chemical changes have been investigated from the point of view of Grotthuss' theory of photochemical action.

The rate of dissolution of copper in ferric sulphate solution is not altered by light, but, as the action is practically instantaneous at the surface of the copper and its velocity is entirely governed by the rate of stirring, it may be of a photochemical nature.

Nascent chlorine produced by electrolysis is without action on acetic acid, and does not resemble chlorine under the influence of sunlight. Similarly, in its substituting action on aromatic hydrocarbons, nascent chlorine resembles chlorine in presence of a halogen carrier rather than chlorine in sunlight, since the latter gives additive products (compare, however, Cohen, Dawson, and Crosland, Trans., 1905, **87**, 1034). When electrolytic chlorine acts on toluene without a halogen carrier, the proportion substituted in the nucleus and in the side-chain depends on current density and temperature, but not on light. In presence of dilute acids or alkalis, electrolytic chlorine also gives additive products with toluene. These facts are held to disprove Lothar Meyer's additive compound theory of the action of halogen carriers, particularly as lead tetrachloride or ferric chloride alone is found to chlorinate benzene under suitable conditions.

The development of a blue colour by ferrocyanide paper in light can be simulated electrolytically. Sulphur obtained by the electrolysis of sulphuric acid is partly insoluble, and in this resembles the sulphur precipitated from solution by the action of light (compare Rankin, Abstr., 1907, ii, 254). With sulphuric acid, using lead electrodes, an alternating current produces luminescence at each electrode. The oxidation of quinine sulphate by solid sodium peroxide is also attended with luminescence.

Not only can oxidation and reduction processes give rise to light, but the converse is also true. It is shown that photographic sensitisers, such as erythrosin, are reduced by light, halogen being in most cases liberated. R. J. C.

Balloon Observations of Atmospheric Radioactivity. Flemming (*Physikal. Zeitsch.*, 1908, 9, 801—803).—The observations were made by suspending weighted copper wires from the balloon, the wires being connected with the two poles of a small dry battery of about 2000 volts. After an exposure of one to two hours, the negative wire was wound up on a wire gauze cylinder, and introduced into an Elster and Geitel apparatus for measuring the ionisation. The observed activities vary very considerably, but show that radium emanation is present in the atmosphere even at a height of 3000 metres above the earth's surface. The highest indications were obtained during a journey in which the meteorological conditions were described as "stormy." H. M. D.

Radioactivity of Rocks and other Materials from the Island of Ischia. Raffaelo Nasini and Mario G. Levi (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 432—434).—The authors give the radioactivities of a number of specimens of pumice, tufa, spring deposits, etc., from the island of Ischia. T. H. P.

Appearance of Radioactivity in Inactive Volcanic Materials of the Last Great Eruption of Vesuvius (April, 1906). Raffaelo Nasini and Mario G. Levi (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 435—437).—Most of the Vesuvian materials, which in June, 1906, were found to exhibit no radioactivity, that is, exhibited a dispersion of less than 1 volt per hour (compare Abstr., 1907, ii, 3), are now found to be distinctly radioactive. The authors suggest that their previous inactivity was due to the fact that they had only recently passed from the liquid to the solid condition (*loc. cit.*).

T. H. P.

Radioactivity of Soil. Fréd. Bordas (*Compt. rend.*, 1908, 147, 924—925).—Glass containing manganese when buried in the soil of certain nitrate districts in Chili develops a violet hue similar to that produced in it by radium. Although samples of the soil examined in Paris were not radioactive, photographic tests made in Chili revealed considerable activity in those districts in which glass was acted on. The author supposes that some relation may exist between terrestial radioactivity and the formation of nitrate deposits. R. J. C.

Instability of Radium Bromide. Sir William Ramsay (*Monatsh.*, 1908, 29, 1013—1016).—The radium salt, weighing 0·388 gram, which the author obtained from the Vienna Academy of Sciences, was examined by converting a small portion into the anhydrous bromide and comparing its activity with that of a small quantity of pure anhydrous radium chloride. The data indicate that the 0·388 gram of material corresponds with 0·4547 gram of anhydrous radium bromide.

The substance was only partly soluble in water, and on treatment with hydrobromic acid, carbon dioxide was evolved. The gases pumped off from the aqueous solution before the hydrobromic acid was added, consisted of hydrogen and oxygen; after the addition of the acid, large quantities of bromine were evolved, together with a little oxygen. After some months, the evolution of bromine ceased, and hydrogen and oxygen were obtained. When the substance was first dissolved in water, 1·312 c.c. of gas were pumped off; this consisted of 0·015 c.c. of carbon dioxide, 0·047 c.c. of hydrogen, 1·125 c.c. of oxygen, and 0·125 c.c. of nitrogen and helium.

The author records that the sealing up of the substance in a small flask in November caused blistering of the fingers in the following June. H. M. D.

Radioactivity of Potassium, with Special Reference to Solutions of its Salts. NORMAN CAMPBELL (*Proc. Camb. Phil. Soc.*, 1908, **14**, 557—567. Compare Abstr., 1907, ii, 597).—The results recorded previously (Campbell and Wood, Abstr., 1907, ii, 217) have been confirmed. All attempts to observe or to produce any difference in the activity of different samples of the same potassium salt in the same physical state were unsuccessful. The activity of a potassium salt is unchanged on heating, and attempts to separate an active component by electrolysis, recrystallisation, and precipitation were unsuccessful.

The activity of a thick layer of a potassium salt is not strictly proportional to the potassium content, possibly because in different compounds the ratio of the density of the substance to the absorption coefficient of the rays emitted by it differs. In the case of solutions, the variations in the value of this ratio are large and irregular. The ratio is not necessarily proportional to the density or concentration of the solution.

In conclusion, it is stated that the method employed by McLennan and Kennedy (Abstr., 1908, ii, 750) for measuring the activity of a salt gives untrustworthy results. W. H. G.

Sodium Emanation. G. COSTANZO (*Ber. deut. physikal. Ges.*, 1908, **6**, 854—857).—It has been stated by Phillips (*Nature*, 1908, **78**, 79) that metallic sodium gives off an emanation and accelerates the discharge of a negatively-electrified electroscope. The author finds that the rate of discharge in an atmosphere of dry nitrogen is not influenced by the presence of sodium. In a second series of experiments, in which dry air was passed over sodium into the chamber of the electroscope, the same rate of discharge was found for both positive and negative electricity as in blank experiments in which the sodium was omitted from the apparatus. H. M. D.

So-called Metallic Radiation. SEM SAELAND (*Ann. Physik*, 1908, [iv], **27**, 903—904).—It is pointed out that the author's observations relating to the photographic activity of metals and hydrogen peroxide (Abstr., 1908, ii, 789) are in satisfactory agreement with the results obtained by O. and A. Dony-Hénault (Abstr., 1908, ii, 647) in an investigation of the supposed radioactivity of hydrogen peroxide. By combining the two series of observations, the possibility that the photographic action is due to an emission of rays or an emanation is completely precluded. H. M. D.

Influence of Temperature on the Transformation of Radioactive Substances. HEINRICH W. SCHMIDT and PAUL CERMAK (*Ber., deut. physikal. Ges.*, 1908, 6, 675—687; *Physikal. Zeitsch.*, 1908, 9, 816—821).—Reference is made to the apparently contradictory results obtained by different observers of the influence of temperature on the properties of radioactive substances. The changes which would result if a rise of temperature exerted an influence on the intensity of the radiation, on the rate of decay of the radioactive substance, or on both these factors are considered.

Experiments are described in which a small quantity of radium bromide was heated electrically in a quartz tube, the β- and γ-radiation being measured separately before, during, and after heating. When the temperature was raised to 1000—1400°, the intensity of the β-radiation diminished considerably; on cooling, a further diminution took place, but after some hours the normal value was again attained. No variation of the intensity of the γ-radiation with the temperature could be detected. When the same sample of radium bromide was enclosed in a second quartz tube and the experiment repeated, the β-radiation was found to remain constant. After repeated heating and cooling, evidence of variation was obtained, and the authors conclude that the observations indicate that quartz undergoes a change of structure under certain conditions and that in the transformed condition it is permeable to the volatile active substances.

It is pointed out that similar observations have already been recorded by Engler (Abstr., 1908, ii, 650). The conclusion is drawn that the radiation and the rate of transformation of the disintegration products of radium as far as radium *C* are independent of the temperature up to 1500°. H. M. D.

Chemically Active Electrical Radiation. A. REMELÉ (*Ber., deut. physikal. Ges.*, 1908, 6, 804—807).—The author has observed that a silver bromide plate is darkened slowly on exposure to boron nitride. The photo-chemical action takes place much more rapidly if the nitride is heated in a Bunsen flame. The active rays pass through paper, leather, and caoutchouc, but not through metals; they do not give rise to ionisation effects. Magnesium and lithium nitride have also been found to exert photochemical action at the ordinary temperature, and uranium nitride is much more active than other uranium salts or minerals. H. M. D.

Reaction Radiation. H. W. WOUDSTRA (*Chem. Weekblad*, 1908, 5, 835—836).—When a photographic plate covered with an aluminium stencil *V* was exposed for five minutes close to a vessel containing 10% calcium chloride into which 10% sulphuric acid was allowed to flow, the letter could be distinctly seen on developing the plate. Neither calcium chloride nor sulphuric acid alone produced any result. With ferric chloride and potassium hydroxide, and with stannous chloride and mercuric chloride or mercurous chloride respectively, the letter appeared light on a dark ground. Mercuric chloride and ferric chloride alone produce the same effect (compare Kof and Haehn, Abstr., 1907, ii, 732).

Willem P. Jorissen (*Chem. Weekblad*, 1908, 5, 836—839.—A summary of other work on the foregoing subject. A. J. W.

Use of the Electroscope in Measuring Activity. J. Olie, jun. (*Chem. Weekblad*, 1908, 5, 823—828. Compare Jorissen and Ringer, Abstr., 1907, ii, 422).—The sources of error incidental to the electroscopic method of measuring activity have been investigated, uranium oxide being employed. Neither the presence of moisture nor the position of the substance on the condenser plate influences the time of discharge, but an uneven distribution of the active substance prolongs the time. The distance between the condenser plates for distances between 3 and 5 cms. has no effect. The total quantity of active substance present is only of importance when the layer is very thin, the discharging action with thick layers taking place at the surface. Diminution in the surface area of the active substance considerably prolongs the time of discharge, which depends, not only on the quantity of material present, but also on its surface area.

Willem P. Jorissen (*Chem. Weekblad*, 1908, 5, 828—830. Compare Rutherford and Grier, Abstr., 1902, ii, 637; Jorissen and Ringer, Abstr., 1907, ii, 731; Cameron and Ramsay, Trans., 1907, 1266 and 1593; Curie and Gleditsch, Abstr., 1908, ii, 793).—A comment on Olie's paper, and a summary of similar work. A. J. W.

Electromotive Force of the Hydrogen-Oxygen Cell. J. N. Brönsted (*Zeitsch. physikal. Chem.*, 1908, 65, 84—92).—From observations on the dissociation of water vapour at high temperatures, Nernst (Abstr., 1906, ii, 17) has obtained the value 1·232 volts at 17° for the *E.M.F.* of the hydrogen-oxygen cell, and this result has been confirmed by Lewis (Abstr., 1906, ii, 262) by measurements of *E.M.F.* and thermal dissociation of silver oxide. The author has re-determined the *E.M.F.* of the cell in question indirectly by a method somewhat similar to that of Lewis, mercuric oxide being used instead of silver oxide.

The *E.M.F.* of the cell

hydrogen | sodium hydroxide | mercuric oxide | mercury

was determined at different temperatures with different concentrations of alkali. From the temperature-coefficient of the *E.M.F.* and the *E.M.F.* of the cell, the heat of oxidation of mercury has been calculated as 22·290 cal., in moderate agreement with the result obtained directly. It is shown that the *E.M.F.* of the hydrogen-oxygen cell can be calculated from the formula $E = 0{\cdot}9290 + RT/4.\log_e 760/p$, where 0·9290 is the potential of the cell above-mentioned when dilute alkali is used as electrolyte, and p is the dissociation pressure of mercuric oxide in contact with mercury, as in the cell. The value of p at 70° has been calculated from the value of the heat of oxidation of mercury obtained as above, and the dissociation pressure of mercuric oxide at high temperatures, determined by

Pélabon. On substituting the value of p thus obtained, in the above formula, the value obtained for the *E.M.F.* of the hydrogen-oxygen cell is 1.238 ± 0.01 volt, in excellent agreement with the values obtained by Nernst and by Lewis. G. S.

Reduction of Cadmium by Mercury and the E.M.F. of Cadmium Amalgams. George A. Hulett and Ralph E. DeLury (*J. Amer. Chem. Soc.*, 1908, 30, 1805—1827).—The work described in this paper was undertaken in order to gain a knowledge of the equilibrium conditions in the system mercury, cadmium sulphate, and water. From the behaviour of standard cells, it seemed probable that mercury reduced cadmium sulphate solution and formed a very dilute amalgam, an equivalent amount of mercury passing into solution.

A study of the *E.M.F.* of very dilute cadmium amalgams has been carried out. A difficulty was experienced at the outset, owing to the ease with which the cadmium in an amalgam undergoes oxidation, and a method was worked out for efficiently preventing oxidation in the preparation and manipulation of amalgams.

All cadmium amalgams containing between 6% and 13% of cadmium have the same potential against an electrolyte, since at the ordinary temperature any amalgam in this range is made up of two phases, and the composition of the liquid depends only on the temperature. When the temperature is fixed, there results a constant reproducible electrode, which renders it possible to detect at once the loss of cadmium from the amalgams and to estimate its amount.

Richards and Forbes (Abstr., 1907, ii, 693) have found that the density is a function of the composition of cadmium amalgams from the pure metal to 3% of cadmium, and it has now been ascertained that this is true up to the saturated amalgam, which contains 5·57% of cadmium.

From a study of the composition and density of the liquid phase of a cadmium amalgam, saturated at 25°, the following relation has been established: $D = 13\,540 - 0.0606 \times p$, with a temperature-coefficient of $-(0.0024 + 0.0003\,p)$, where p is the percentage of cadmium in the amalgam.

A method is described for removing oxygen from a solution and saturating the latter with hydrogen, and for effectively removing the residual oxygen from a cell and its contents.

Measurements have been made of the *E.M.F.* of cadmium amalgams at 25°, extending from the saturated amalgam to a dilution of 1 part of cadmium in 10^8 parts of mercury, and the results are tabulated. The most trustworthy value seems to be 0·052940 for the 1 : 1000 amalgam.

It has been found that any two amalgams from 1 : 100 to 1 : 10^6 show an *E.M.F.* which is in agreement with the requirements of the gas laws, but a deviation from these requirements has been found for amalgams of greater dilution than 1 : 10^6. This deviation is regarded as evidence that the reduction of mercury by cadmium is a reversible reaction which does not go to completion, but that a definite equilibrium is established. E. G.

A New Method of Calculating the Ratio of the [Electric] Charge to the Mass of the Molecule of Mercury Vapour. Robert Fürstenau (*Physikal. Zeitsch.*, 1908, 9, 849—851).—On the assumption that the equations of Drude and Lorentz for the thermal and electrical conductivities of metallic conductors can be applied to mercury vapour, the author shows that it is possible to obtain the ratio e/m of the electrical charge to the mass of the mercury molecule. According to Drude's equation, $e/m = 9{\cdot}38 \times 10^3$, whilst Lorentz's equation gives $7{\cdot}62 \times 10^3$. The former value agrees very well with the value of the ratio, $9{\cdot}53 \times 10^3$, obtained by Wien for the canal rays in an atmosphere of pure hydrogen. H. M. D.

Electrical Conductivity of Magnesium-Lead Alloys. N. J. Stepanoff (*Zeitsch. anorg. Chem.*, 1908, 60, 209—229 *).—The alloys were fused under a layer of potassium and lithium chlorides, and drawn by a pump into previously heated hard glass tubes, coated internally with lamp-black. After slow cooling, the glass tube was carefully broken away, leaving rods 3—4 mm. in diameter. This method is suitable for brittle and oxidisable metals.

The conductivity of each alloy was measured at 25° and at 100°. The results are in accordance with the indications of the freezing-point curve (Kurnakoff and Schemtschuschny, Abstr., 1908, ii, 932), but the formation of a solid solution, containing up to 4 atomic % of lead, is indicated. The compound Mg_2Pb has a conductivity 8·55 times less than that of lead. C. H. D.

Conductivity of Acid Solutions in Presence of Salts. M. Pouchon (*Chem. Zentr.*, 1908, ii, 1005; from *Le Radium*, 1908, 5, 167—170. Compare Abstr., 1908, ii, 346).—Similar results to those recorded by Boizard (*loc. cit.*) have been found with phosphoric acid and its salts, namely, that the conductivity of the acid is lowered by the addition of its salts. Employing Kohlrausch's method, slightly modified, a decrease in conductivity was observed at the first additions of mono-, di-, or tri-potassium phosphate, but on further additions of salt the conductivity increased. This may be explained by the formation in solution of the complex substance H_3PO_4,KH_2PO_4, obtained in the crystalline form by Staudenmeyer (Abstr., 1904, ii, 137).

J. V. E.

Electrical Conductivity of Salts and Mixtures of Salts. Alfred Benrath (*Zeitsch. physikal. Chem.*, 1908, 64, 693—706).—The electrical conductivity of the solid nitrates of potassium, sodium, and silver has been determined at a series of temperatures up to the respective melting points, and the conductivity of the solid binary systems KNO_3–$NaNO_3$ and $NaNO_3$–$AgNO_3$ has also been measured at different temperatures. The solid salts were strongly compressed into small cylinders, the ends of the cylinders covered with a thin layer of graphite, and connexion made with the circuit by means of platinum disks pressed firmly against the ends. The resistances were measured by Kohlrausch's method. Special precautions were taken to exclude the effect of adsorbed moisture.

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* and *J. Russ. Phys. Chem. Soc.*, 1908, 40, 1448—1467.

There is an enormous diminution in the resistance of all three salts when the melting point is reached, the resistance of the crystalline salt being more than 10,000 times as great as that of the fused salt in each case. The sudden change in conductivity may therefore be made use of for determining melting points. The relation between the specific conductivity, κ, of the solid salt and the temperature, t, is given by the equation $\log \kappa = a + bt$, where a and b are constants.

The melting-point curves for the binary systems KNO_3–$NaNO_3$ and $AgNO_3$–$NaNO_3$, determined by the above method, are in fair agreement with those determined in the usual way. Further, the isothermals for the binary systems, obtained by plotting the composition as abscissæ against the conductivity as ordinates, have been determined at 180°, 190°, and, for the system $NaNO_3$–KNO_3, also at 200° and 210°. For the latter system, the isothermals rise rapidly from the points representing the conductivity of the pure salts, but there is an intermediate part which alters in a linear manner with concentration. It may be anticipated that the rising parts of the curve correspond with mixed crystals, and the linear part with the presence of two non-miscible components, which do not enter into chemical combination. The above observations may therefore be used to determine the limits within which mixed crystals are formed, and the results agree fairly well with those obtained by the usual methods. The results for the system $AgNO_3$–$NaNO_3$ are similar, but less regular. The results therefore indicate that the conductivity of mixed crystals of salts is greater than that of the components, the converse of the behaviour of metals. G. S.

Abnormal Course of Curves, showing the Change of Molecular Conductivity with the Concentration. WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1243—1247).—According to Steele, McIntosh, and Archibald (Abstr., 1905, ii, 222; 1907, ii, 526), abnormal diminution of electrical conductivity of non-aqueous solutions on dilution may be explained by assuming that the electrolyte consists of a complex formed of n (2 or 3) mols. of the solute with m mols. of the solvent. On the basis of this hypothesis, they show that $xV^n = \alpha K$, where x represents the specific conductivity, V the dilution, α the degree of the dissociation of the electrolyte, and K a constant. From the numbers given by these authors for the conductivities of solutions of potassium iodide in amylamine, the author shows that xV^n only ceases to exhibit a maximum when $n = 6$. The above hypothesis is rendered improbable by the large number of hydrates known, and by the fact, generally accepted, that ionisation in aqueous solution is always accompanied by hydration. This hypothesis is also quite incapable of explaining the results of Franklin and Gibbs (Abstr., 1907, ii, 840), who found that, for solutions of silver nitrate in methylamine, the molecular conductivity at first increases with the dilution, then decreases, and afterwards increases again. T. H. P.

Limiting Conductivity and Degree of Ionisation of Alcoholic Solutions. BENJAMIN B. TURNER (*Amer. Chem. J.*, 1908, 40, 558—574).—Determinations have been made of the conductivity of alcoholic solutions up to dilutions of 20,000 to 50,000 litres. The precautions to be observed in such work have been carefully studied. It has been found that when alcohol of very low conductivity is placed in new glass vessels which have been cleaned and dried in the usual way, an error is introduced which leads to inconsistent results at high dilutions. It appears that in drying, either the surface of the glass becomes loosened or the solvent action of the drops of water on the glass at the high temperature used is sufficient to increase greatly the conductivity of the alcohol which is afterwards put into the vessel.

The conductivity of alcoholic solutions of potassium iodide between 0° and 78° has been measured, and it has been found that the molecular conductivity reaches a maximum of $48{\cdot}5 \pm 0{\cdot}5$ reciprocal ohms at 25° at about 20,000 litres dilution. A similar maximum appears to exist at all temperatures. The ionisation constants have been calculated for all the concentrations and temperatures. The temperature-coefficients increase with the temperature, and most markedly in the case of very dilute solutions. At any given temperature, the temperature-coefficient increases with the dilution. The ionisation decreases as the temperature rises. A $0{\cdot}1N$ solution is dissociated to the extent of 49% at 0°, 46% at 25°, and about 35% at the b. p. The temperature-coefficient for pure alcohol is much less than for alcohol of conductivity $0{\cdot}3 \times 10^{-6}$, and may even be negative.

Measurements have also been made with lithium chloride and bromide, but the results are regarded as less accurate than those obtained with potassium iodide.

The values for the conductivity of alcoholic solutions of potassium iodide agree fairly closely with those obtained by Dutoit and Rappeport (Abstr., 1908, ii, 924). E. G.

Electrical Conductivity of Solutions of Compounds of Dimethylpyrone with Tribromoacetic Acid in Ethyl Bromide.

WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1238—1243. Compare Abstr., 1908, i, 281).—The electrical conductivity of a solution of a mixture of dimethylpyrone and tribromoacetic acid in ethyl bromide gradually diminishes, owing to the decomposition of the compound formed by the two solutes. This decomposition, which is rendered evident by the solution becoming brownish-green, is, however, sufficiently slow to allow of comparable numbers being obtained by measurements made immediately the solutions are prepared.

The molecular proportions of dimethylpyrone and tribromoacetic acid in the solutions examined were 1 : 1, 1 : 2, 2 : 1, and 1 : 3. The conductivity of the compound $C_7H_8O_2,2CBr_3{\cdot}CO_2H$ in ethyl bromide is considerably less than that of the analogous compound

$$C_7H_8O_2,2CCl_3{\cdot}CO_2H$$

(compare Abstr., 1905, ii, 433), but the curves connecting conductivity and concentration are perfectly similar in the two cases. The conductivity of the compound $C_7H_8O_2,2CBr_3{\cdot}CO_2H$ is considerably greater than that of the compound $C_7H_8O_2,CBr_3{\cdot}CO_2H$, whilst that of the compound $2C_7H_8O_2,CBr_3{\cdot}CO_2H$ is extremely small. Addition of a greater proportion of tribromoacetic acid than corresponds with the compound $C_7H_8O_2,2CBr_3{\cdot}CO_2H$ causes a diminution of the conductivity, which, for $C_7H_8O_2,3CBr_3{\cdot}CO_2H$, lies between the conductivities of $C_7H_8O_2,CBr_3{\cdot}CO_2H$ and $C_7H_8O_2,2CBr_3{\cdot}CO_2H$.

T. H. P.

Oxide Theory of the Oxygen Electrode. RICHARD LORENZ (*Zeitsch. Elektrochem.*, 1908, **14**, 781—783).—After referring to his previous work (Abstr., 1906, ii, 825), the author states that he has been observing the discharge curves of polarised electrodes, using a galvanometer in series with a very large resistance, so as to obtain a slow discharge. The *E.M.F.* at which the discharge occurs corresponds with some change at the electrode, and it is not complicated by *E.M.F.*'s due to changes of concentration in the electrolyte.

T. E.

Calorimetric Determination of Heat Development at Electrodes. P. BRÄUER (*Zeitsch. physikal. Chem.*, 1908, **65**, 111—120).—The heat developed at the electrodes of the cell

$$Cu \mid CuSO_4N/1 \mid CuSO_4N/1 \mid Cu$$

when a current is sent through it has been determined directly, and the same factor has also been calculated indirectly from the magnitude of the temperature-coefficient of the same cell, which has been carefully re-determined.

The direct determination of the heat set free at the electrodes was made as follows. A small glass calorimeter, the bottom of which was a porous plate, and filled with $N/1$ copper sulphate solution, was immersed nearly to the rim in a wider vessel, also containing $N/1$ copper sulphate. Both compartments were provided with stirrers and thermometers, and in each a copper electrode was placed. The contents of the inner vessel were then cooled slightly, and a current of 0·5 ampere passed through the cell for sixteen minutes, the thermometers being read at intervals. The heat developed in the calorimeter, referred to $F=96,540$ coulombs, is represented for the anode compartment by the expression $Q+F\pi-j$, and for the cathode compartment by the expression $Q-F\pi+j$, where Q is the Joule heat developed, π is the *E.M.F.* at the junction electrode/solution, and j the heat of ionisation of copper; hence, from the observed data, the value of $F\pi+j$ for 1 gram-equivalent of copper is 4464 cal., or for a gram-atom of copper, 8930 cal.

The temperature-coefficient of the same cell was also determined by measuring by the compensation method the *E.M.F.* between two similar cells differing in temperature by a few degrees; the value obtained was 0·00069 volt per degree, about 10% higher than Bouty's value (*J. Phys.*, [i], 9, 229; [ii], 1, 267). From this result, the heat developed, W, at the electrodes was calculated by the usual formula: $W=nFT.d\pi/dT$; the value obtained was 9320 cal., in fair agreement with the above value. From the last-mentioned result, it is calculated that the heat of ionisation of copper is 18,800 cal., as compared with 17,500 cal. calculated by Ostwald.

G. S.

Thermo-electric Forces in Electrolytes. Emil Podszus (*Ann. Physik*, 1908, [iv], 27, 859—889).—The thermo-electric differences of potential resulting from the juxtaposition of a cold and a hot pair of dilution solutions of different electrolytes have been measured. It is found that the thermo-electric potential is proportional to the difference of temperature, and for a given pair of electrolytes is almost independent of the concentration of the solutions. When different salts are combined with the corresponding acid to form a pair, it is found that the order in which the cations succeed one another, when arranged in the order of the thermo-electric difference of potential, is independent of the anion with which they are associated. For the electrolytes examined, the order is lithium, ammonium, sodium, potassium, magnesium, copper, barium, and iron (ferric). A similar relationship is found in the case of the anions, the order being sulphate, chloride, iodide.

In general, the direction of the current due to the thermo-electric force is from the cold to the hot pair of solutions. H. M. D.

Magnetic [Susceptibilities] of the Rare Earths. Stefan Meyer (*Monatsh.*, 1908, 29, 1017—1022).—The author has compared the magnetic susceptibilities of the oxides of the two elements into which von Welsbach claims to have resolved ytterbium. Referred to one gram-atom, the magnetic susceptibility of aldebaranium is 9·15, and that of cassiopeium, 1·9. The difference between the two values corresponds with the much greater number of lines in the spectrum of the former element.

The spectra of holmium and dysprosium and the magnetic susceptibilities of the corresponding oxides are compared, and the conclusion is drawn that a strongly magnetic element having a large number of lines in its spectrum is present with dysprosium in holmium.

H. M. D.

Magnetic Properties of the Alloys of Ferromagnetic Metals. Gustav Tammann (*Zeitsch. physikal. Chem.*, 1908, 65, 73—83).—Some general rules are given for the magnetic behaviour of alloys containing iron, cobalt, and nickel. The experimental data are mainly taken from papers by the author and his co-workers published during the last three years.

Apparently without exception, mixed crystals in which a ferromagnetic metal acts as solvent are magnetic, but similar crystals in which the non-magnetic metal acts as solvent, that is, is present in much the greater proportion, are non-magnetic. Chemical compounds containing iron, cobalt, and nickel are practically non-magnetic.

The temperatures at which the magnetic properties disappear on heating are only altered by the addition of other substances when the latter are soluble in the non-magnetic form. The effect of other substances on the transition temperature is usually to lower it. Van't Hoff has shown that (1) when the metal separates in the pure state at the transition temperature, and (2) when the work done in separating the pure metal from the mixed crystal can be calculated from the laws of osmotic pressure, the influence of foreign metals on the transition temperature of the ferromagnetic metal can be calculated by the formula (the same as that for the freezing-point depression) $dT = 0{\cdot}02T^2/W$, where W is the latent heat of fusion of the latter metal. The author shows from the available data that the experimental values of dT and those calculated from the above formula are very seldom in agreement, from which the conclusion is drawn that neither of the assumptions on which van't Hoff's formula are based are necessarily valid. G. S.

Hydration of Ions Calculated from Transference Numbers and Electromotive Forces. B. REINHOLD (*Zeitsch. Elektrochem.*, 1908, 14, 765—766).—If the anion and cation of an electrolyte carry different numbers of molecules of water with them, the changes of concentration at the electrodes are partly due to this and partly to the different mobilities of the ions. If the real mobilities are known, it is possible to calculate the difference in the degree of hydration of the ions either from direct determinations of the transference numbers or from the *E.M.F.* of a concentration element. T. E.

Decomposition of Complex Ions. WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1247—1257).—The mutual action of the components of complex ions serves to explain syntheses in presence of aluminium chloride or bromide, the catalytic properties and tendency to react of this salt standing in close relation to the propensity of the aluminium atom to form complex ions. In the majority of instances, the products of the reaction are electrolytes, and the whole course of the reaction can be explained by the formation of these complex ions. This view is supported by the electrochemical properties of the compounds of aluminium bromide with ether (Abstr., 1907, i, 580), and explains the decomposition of this complex compound on dry distillation. The electrochemical properties of the compounds formed by aluminium bromide, bromine, and carbon disulphide, and of the compounds of dimethylpyrone with trichloroacetic acid (compare Abstr., 1905, ii, 433) and tribromoacetic acid (compare this vol., ii, 14), are discussed in relation to the views of Hantzsch (Abstr., 1908, ii, 14).

The mechanism of the decomposition of the compounds of aluminium bromide with toluene and benzene by electrolysis (compare Abstr., 1908, i, 407) is discussed. T. H. P.

Ratio of the Specific Heats of Gases and its Dependence on the Temperature. ROBERT FÜRSTENAU (*Ann Physik*, 1908, [iv], 27, 735—772*).—The author has investigated the variation of the ratio of the specific heats with the temperature for several gases by measurements of the wave-lengths of sound according to the resonance method. Two exactly similar pieces of apparatus were used in the experiments, one of these being used for the examination of the gases at higher temperatures, the other for a comparative measurement at the ordinary temperature. By this means it was possible to eliminate errors which would result from a gradual alteration in the pitch of the source of sound.

The experimental results indicate that between 0° and 500° the ratio of the specific heats of air is constant within 1%. For carbon dioxide and sulphur dioxide, the values of the ratio are respectively 3·5% and 4·8% less at 500° than at 0°. For a rise of temperature from 0° to 300°, the ratio in the case of ethyl chloride diminishes to the extent of 3·4%.

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* and *Ber. Deut. physikal. Ges.*, 1908, 6, 968—979.

From Regnault's determinations of the specific heat of carbon dioxide at constant pressure between 0° and 200°, and the corresponding values obtained by the author for the ratio of the specific heats, the following values are obtained for the specific heat at constant volume: 0°, 0·1436; 100°, 0·1654; 200°, 0·1856. For this range of temperature, the value of c_v increases to the extent of 29%.

H. M. D.

Condition of Substances in Absolute Sulphuric Acid. III. ARTHUR HANTZSCH (*Zeitsch. physikal. Chem.*, 1908, 65, 41—60. Compare Abstr., 1908, ii, 14, 462).—The statement in the previous paper, that substances which dissolve in absolute sulphuric acid as hydrogen sulphates give values for the molecular weight rather less than two-thirds, but always more than half, the theoretical value, and that the apparent molecular weights are practically independent of the dilution, is confirmed by further experiments. In some cases, however, such as acridine, the values in the most dilute solutions are much higher. Acetonitrile and certain other acid nitriles, as well as benzil and benzophenone, also give about two-thirds of the theoretical depression, and are dissolved as hydrogen sulphate; the alcohols, however, only give about one-third of the theoretical depression, being changed by the solvent to alkylsulphuric acids and water.

As regards nitro-compounds, di- and tri-nitrobenzene and nitromethane give the theoretical depression, but *p*-nitrotoluene causes considerably less than the theoretical depression.

Weak acids, the affinity constants of which can be readily determined, behave cryoscopically like water or ammonia, and are therefore present in solution as acylhydronium salts, formed according to the equation: $AcOH + HSO_4H = AcOH_2{\cdot}SO_4H$. Moderately strong acids, such as trichloroacetic, oxalic, and picric acids, give the theoretical depression, and are probably present as such in solution. The strongest acids, on the other hand, give less than the theoretical depression, and form conducting solutions with sulphuric acid; the ions are probably produced by dissociation of complex compounds of solute and solvent. The dissociation of the sulphonic acids increases in the order: benzenesulphonic acid, *p*-toluenesulphonic acid, azobenzenesulphonic acid; the latter is apparently about one-third ionised. Phosphorous and metaphosphoric acids behave as if split up into two ions, whilst nitric acid gives about four times the theoretical depression, and the solution probably contains a highly ionised complex acid.

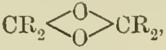
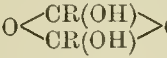
G. S.

Fused Salt Hydrates as Solvents for Freezing-point Determinations. G. COOK (*Zeitsch. anorg. Chem.*, 1908, 60, 191—192).—Morgan and Benson (Abstr., 1907, ii, 747) have determined the lowering of freezing point produced by the addition of water to fused salts, and hence calculated the molecular weight of water; in the case of calcium chloride hexahydrate as solvent, the results approximated to the theoretical value, 18. The present author's experimental results are in approximate agreement with those of Morgan and Benson, but the calculations of the latter observers are erroneous; the value for the molecular weight of water in fused calcium chloride hexahydrate is over 200 in 4% solution. Fused salt hydrates are therefore not suitable solvents for determining the molecular weight of other hydrates by the freezing-point method. G. S.

_cyclo_Hexane as a Cryoscopic Solvent. Luigi Mascarelli (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 494—498. Compare Abstr., 1907, ii, 602).—The author has investigated the cryoscopic behaviour of a number of compounds of various types dissolved in *cyclo*hexane, with the following results.

Normal behaviour is exhibited by methylacetanilide in low concentrations, and also by *p*-dichlorobenzene and *s*-tribromophenol, the last-named being the only hydroxy-compound of those examined which does not show an abnormally high molecular weight in *cyclo*hexane.

The following compounds all produce abnormally low depressions of the freezing point of *cyclo*hexane: *tert.*- and active amyl alcohols, *sec.*- and *iso*-butyl alcohols, menthol, and borneol; camphoroxime, carvonoxime, and acetophenoneoxime; *o*-, *m*- and *p*-cresols, thymol, and phenol; acetone, methyl ethyl ketone, acetylacetone, ethyl acetoacetate, acetophenone, benzophenone, 2-methyl*cyclo*hexanone, and 4-methyl*cyclo*hexanone; acetic and benzoic acids; nitrobenzene, *o*-, *m*- and *p*-nitrotoluenes, nitromethane, and nitroethane.

The author regards the abnormal behaviour of ketones as due to association, partly of the enolic form and partly of the ketonic form, R·CO·R, to the complex,  $CR_2{<}{\genfrac{}{}{0pt}{}{O}{O}}{>}CR_2$, which is similar to the associated molecules,  $O{<}{\genfrac{}{}{0pt}{}{CR(OH)}{CR(OH)}}{>}O$, formed by the carboxylic acids, $R \cdot CO_2H$.

Ebullioscopic measurements of solutions of naphthalene, benzil, diphenyl, and phenyl benzoate in *cyclo*hexane give the mean value 27·53 for the molecular elevation of this solvent. T. H. P.

Dependence of the Melting Point of a Solid Substance on its Surface Energy. P. Pawloff (*Zeitsch. physikal. Chem.*, 1908, 65, 1—35).—It has been shown by Ostwald and others that the solubility of a solid is the greater the more finely divided it is, and the author now shows, mainly from experiments with salol, that the more finely divided a solid is, the lower is its melting point.

The statement in question was proved by three different methods: (1) Salol, powdered to different degrees of fineness, was spread out on a thin glass plate, heated at definite, gradually increasing temperatures for short periods, and then examined under the microscope. The size of the largest drops was determined with a micrometer eyepiece, and this was taken as a measure of the fusibility of the particles.

Particles of commercial (impure) salol of diameter 8 μ ($\mu = 0{\cdot}001$ mm.) fuse at a temperature 3·5° lower than those of diameter 32 μ. When recrystallised once from methyl alcohol, however, particles of 6—40 μ in diameter melt within limits of temperature of 1·5°. (2) Salol was heated at definite intervals of temperature, as in the previous experiments, and observations made of the size of the smallest particles, the edges of which were not altered in appearance by this process. It was found that for a fairly pure (high melting) specimen of commercial salol, particles of size 7 μ fused 1·1° lower than those of 40 μ. Particles of twice recrystallised salol, however, of diameters 2—40 μ fused within 1·1°. (3) When a finely-powdered solid in a thin-walled test-tube is placed in a thermostat, the temperature of which is gradually raised, a mist ultimately appears on the wall of the tube, and the appearance of this mist coincides with the melting point of the smallest particles of the substance. In this way it has been shown that a powder composed of particles less than 2 μ melts in the case of salol 7°, in the case of antipyrine 5—7°, and in the case of phenacetin 4°, lower than particles of diameter 0·5—2·0 mm.

The lowest attainable temperature in the region of fusion is determined by the melting point of the crystalline germ of maximum surface, and larger solid particles above this temperature may be regarded as superheated. Similarly, the supercooling of liquids is a general phenomenon ; a liquid supercooled to a definite extent is in equilibrium with solid particles of a definite size, larger particles cause crystallisation, smaller particles dissolve. The limit of supercooling is that temperature below which the crystalline germ can arise of itself in the interior of the liquid. G. S.

Measurement of Very Low Temperatures. XXI. Standardisation of Temperatures by means of Boiling Points of Pure Substances. Determination of the Vapour Pressure of Oxygen at Three Temperatures. H. KAMERLINGH ONNES and C. BRAAK (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 333—341).—The points of a temperature scale fixed by means of the b. p.'s of pure substances have the advantage over those fixed with resistance thermometers and thermo-elements in that they facilitate comparison of thermometers in different laboratories, and do not depend on the durability of special apparatus. The b. p. of oxygen under a pressure of 760 mm., 516·19 mm., and 366·24 mm. at sea-level, and 45° northern latitude, was found to be respectively −182·986°, −186·542°, and 189·442° on the absolute scale (compare Travers, Senter, and Jaquerod, Abstr., 1903, ii, 9 ; Grunmach, Abstr., 1906, ii, 655). W. H. G.

Determination of Boiling Points of Very Small Quantities of Liquids. L. O'DOWD and F. MOLLWO PERKIN (*Trans. Faraday Soc.*, 1908, **4**, 95—98).—The liquid is heated in a small test-tube in a sulphuric acid bath. A small capillary tube, sealed at one end, is placed in the liquid with the open end downward. The whole is heated until bubbles are given off freely from the capillary, and the outer liquid is then slowly cooled. The temperature at which bubbles just cease to be given off is the boiling point. C. H. D.

New Method for Determining Vapour Densities. IV. Philip Blackman (*Ber.*, 1908, **41**, 4141—4144. Compare Abstr., 1908, ii, 564).—The author describes three forms of an apparatus which is practically a modification of the well-known Hofmann apparatus. A formula for the calculation of the vapour density and a table of results are given. C. S.

Influence of Dissociation on the Vapour Pressure of Solids. Andreas Smits and F. E. C. Scheffer (*Zeitsch. physikal. Chem.*, 1908, **65**, 70—72).—It has been found by Ramsay and Young (*Phil. Trans.*, 1886, **177**, 71) that the vapour pressure of acetaldehyde-ammonia is different when determined by a static and by a dynamic method. If, as seems probable, this is due to the slow attainment of equilibrium, there is here an example of a different pressure-temperature curve for a dissociated and a practically undissociated vapour. On the other hand, the pressure-temperature curves for dissociated and undissociated ammonium chloride coincide, and the authors intend to investigate cases of the first type in order to throw light on the nature of the latter phenomenon. G. S.

Vaporisation. III. Hanns von Jüptner (*Zeitsch. physikal. Chem.*, 1908, **64**, 709—726. Compare Abstr., 1908, ii, 810).—Starting with the well-known expressions for the values of the critical constants, p_k, v_k, and T_k, in terms of a, b, R, and T, derived from van der Waals' equation (with certain modifications), a number of other relationships between these factors are deduced, and are employed more particularly to calculate the molecular association and the internal pressure at the critical point for a large number of substances.

If there is molecular association at the critical point, there will not simply be 1 mol. in the volume v_k (as there is in the gaseous volume v under ideal conditions), but n mols., where $1/n$ is the degree of association; hence the general equation $(p + \pi)(v - b) = RT$, where π is the internal pressure, becomes: $(p + \pi)(v - b) = nRT$. The value of n has been calculated for a large number of substances by different methods based on the relationships referred to above, but the agreement is only moderate, partly owing to the uncertainty in the critical data. As a mean of the results, $n = 0·6918$; in other words, the molecular complexity of gases under critical conditions is, in general, about 1·5 times the value under ideal conditions.

Further, the value of π_k, the internal pressure at the critical point, is calculated for a number of monatomic, diatomic, triatomic, and also more complicated substances. As a rule, a_k and b_k increase regularly with the molecular weight, a_k for water being an exception, but for simple compounds containing the same number of atoms, p_k and π_k do not, as a rule, alter greatly with the molecular weight. In complex molecules, however (as shown in homologous series), p_k and π_k diminish with increasing molecular weight. It is also shown that π_0, the internal pressure at the absolute zero, $= 48p_k$, and the limiting value of π_0 in atmospheres for a number of substances is given.

Finally, certain relations between the latent heat of vaporisation and the internal pressure are deduced. G. S.

Binary Mixtures and Concentrated Solutions. FRIEDRICH DOLEZALEK (*Zeitsch. physikal. Chem.*, 1908, **64**, 727—747).—As is well known, the total vapour-pressure curve of binary mixtures belongs to one of three types: it may be a straight line, or may be concave or convex with regard to the axis of composition. It is now shown that the regular form of the curve is a straight line, and that the apparent exceptions occur (1) when one or both of the components is complex, the curve being then concave to the axis of composition, (2) when the components enter into chemical combination, the curve being then convex towards the axis of composition.

The composition of the mixture is expressed as the relative number of mols. of each component present, and not as the relative concentrations by volume. Then, from Nernst's law of partition, the following law is deduced. The partial pressure of each form of substance in the vapour phase is proportional to the molar proportion of it present in the mixture. Hence, if for 1 mol. of one component, n mols. of the other component are present, the respective partial pressures p and π of the components are given by the equations $p = p_0.1/(1 + n)$ and $\pi = \pi_0.n/(1 + n)$, where p_0 and π_0 represent the saturation pressures of the liquefied simple molecules of the two components.

On this basis, comparatively simple formulæ have been derived which give the relationship between the partial and total pressures and the constant for the equilibrium between simple and complex molecules, or between a chemical compound and its components. As an illustration of a system consisting almost entirely of simple molecules which enter into chemical combination, the system acetone–chloroform is considered, and it is shown that a compound is formed containing 1 mol. of each of the components. Further, the formulæ are applied to mixtures of benzene and carbon tetrachloride, the latter substance being partly polymerised, and it is shown that at 50° carbon tetrachloride contains about 15% of double molecules. Similarly, from partial pressure observations of mixtures of ether (simple) and methyl salicylate (complex), it is calculated that at 14° the latter, mixed with 34% by weight of ether, consists to the extent of 70% of double molecules.

The equations in question therefore allow of the determination of the constitution of mixtures and also of pure liquids, and the method is the only one for determining the molecular complexity of liquids which has a satisfactory theoretical basis. However, aqueous solutions, on account of their complexity, cannot readily be dealt with in this way.

The experimental data as to total and partial vapour pressures of binary mixtures, on which the above considerations are based, are mainly due to Zawidski (Abstr., 1901, ii, 6). G. S.

Determination of the Vapour Density of Mixed Liquids. K. W. CHARITSCHKOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1335—1337).—The methods of Dumas, Victor Meyer, and Hofmann for determining vapour densities are applicable only to individual liquids, since, with mixtures of liquids with widely varying boiling points, the high temperature necessary for complete vaporisation is liable to cause decomposition of the constituents with low boiling points. In such a case, the liquid must be fractionated, and the vapour density of the mixture calculated from the proportions and vapour densities of the various fractions. The author has applied this method to several high and low boiling portions of Grosny naphtha, the molecular weights of the fractions being determined by physico-chemical methods, and the heat of vaporisation calculated by means of Trouton's formula. For the naphtha boiling at 100—200°, the vapour density rises, and the heat of vaporisation falls regularly as the boiling point rises. But with the portion boiling below 100°, the fraction b. p. 40—50° exhibits a maximum heat of vaporisation and a minimum vapour density. In this way, it is possible to draw conclusions concerning the presence of individual hydrocarbons in the complex mixtures representing naphthas. T. H. P.

Catalytic Displacement of Equilibrium in the Vaporisation of Ammonium Chloride, from the Point of View of Thermodynamics. Rudolf Wegscheider (*Zeitsch. physikal. Chem.*, 1908, **65**, 97—110).—The fact that ammonium chloride has the same vapour pressure in the perfectly dry and in the moist state, (compare Abegg, Abstr., 1908, ii, 157) is only reconcilable with thermodynamics if the solid salt is in different conditions in the two cases. The two states may be polymorphous forms, one being changed into the other under the influence of water vapour. Another possibility is that one form has a greater internal pressure than the other, this being brought about by an alteration of the surface condition of one of the forms under the influence of water vapour. A mathematical discussion of these possibilities is given. G. S.

Vapour Pressure of the Ammonium Halogen Compounds. Frederick M. G. Johnson (*Zeitsch. physikal. Chem.*, 1908, **65**, 36—40).—The vapour pressures of ammonium bromide and iodide have been determined through a wide range of temperature by the method previously used for the chloride (Abstr., 1908, ii, 157). In the case of the iodide, the results are somewhat complicated by the secondary dissociation of the hydrogen iodide, but as the latter reaction is slow at relatively low temperatures, the error is slight when the measurements are made rapidly.

On the assumption that dissociation in all three cases is complete, the heats of vaporisation have been calculated from the pressure-temperature curve by means of the equation $d(\log p)/dt = Q/2RT^2$. The results are: for ammonium chloride, 37·8 Cal. per mol. between 245° and 345°; ammonium bromide, 45·4 Cal. per mol. between 296° and 394°; ammonium iodide, 44·5 Cal. per mol. between 286° and 392°. G. S.

Thermochemical Investigations of Organic Compounds: Aliphatic Series. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1257—1323).—The author discusses the theories of Clarke (Abstr., 1903, ii, 8), Lemoult (Abstr., 1904, ii, 310), and Thomsen

(Abstr., 1904, ii, 605) concerning the heats of formation of organic compounds, Thomsen's theory being considered in connexion with the following classes of compounds: paraffins; hydrocarbons containing one or more double linkings; hydrocarbons containing triple linkings; ethers; alcohols; esters; acids; aldehydes, and ketones.

The following are the general conclusions drawn from a consideration of the results obtained for the heats of formation of organic compounds by Thomsen and other investigators, mainly of the French school. The law of the constancy of the heat of formation of atomic linkings formulated by Thomsen does not hold, or, at the most, only applies in the case of molecules containing completely saturated atomic linkings. All the conclusions, such as the equality of the heats of formation of double and single linkings, drawn by Thomsen on the basis of his expression for the heat of formation (which the author considers to be incomplete) must also be regarded as invalid. All hypotheses based on expressions, such as $x+\omega-z-v=A$ and $y+\omega-2z=B$, given by Thomsen for his constants, must hence be excluded.

Unsaturated linkings are functions of the mass or molecular weights of the compounds. Increase of the molecule always raises the heat effect of the formation of unsaturated linkings or favours their saturation. This influence depends, not only on the molecular weight, but also on the structure of the compound; with all substances in which heavy atoms or radicles are heaped up near the double linking, the heat of formation is influenced very considerably. The heats of formation of atomic linkings retain their special characters quite independently of the chemical characteristics of the compound in which they occur. Thus the heat of formation of the linking C—O in an ether differs from that of the same linking in an alcohol only to the extent to which it is influenced by the presence of heavy radicles.

The author also discusses the mutual influence of several unsaturated linkings, of similar or different structure, in 1 molecule; the deviations from general regularities in the series of aldehydes and ketones, and also in formic and acetic acids; deviations caused by the presence of an amyl group in the various classes of compounds considered; and many other points influencing the heat of formation. T. H. P.

Temperature-coefficient of the Molecular Surface Energy of Equimolecular Mixtures of Aniline and the Three Isomeric Nitrophenols. Robert Kremann and E. Philippi (*Monatsh.*, 1908, 29, 891—894).—From measurements of the density and the capillary rise of the three isomeric nitrophenols, and of equimolecular mixtures of these with aniline at a series of temperatures, the temperature-coefficients of the molecular surface energy have been calculated. The values indicate that the three nitrophenols, and, in particular, the meta-compound, are to some extent associated. The values for the equimolecular mixtures are normal, and from this the conclusion is drawn that the three nitrophenols do not form compounds with aniline in the liquid condition. The normal values indicate, further, that the tendency to association which the nitrophenols exhibit in the free condition is inhibited in presence of aniline. H. M. D.

Tate's Law. THEODOR LOHNSTEIN (*Zeitsch. physikal. Chem.*, 1908, **64**, 686—692).—Morgan and his co-workers (Abstr., 1908, ii, 356, 668) have brought forward evidence in favour of the validity of the empirical law proposed by Tate, according to which $G = K2r\pi a$, where G represents the weight of a drop falling from a tube of the external diameter $2r$, a is the capillary constant of the liquid, and K is a constant which is the same for all liquids. On the other hand, the author has previously pointed out (*Ann. Physik*, 1906, [iv], **20**, 237; 1907, **22**, 767) that the weight of a falling drop is not in general proportional to the capillary constant of the liquid; the true relation between these factors is given by the equation $G = 2r\pi af(r/a)$, where $a = \frac{1}{2}a^2\sigma$, σ representing the density of the liquid. It is shown that the experimental data of Morgan and his co-workers are more in accordance with the above formula than with Tate's "law." When r/a varies between 0·3 and 2·0 (the usual limits in practice), the value of $f(r/a)$ only varies from 0·6 to 0·7, so that within these limits Tate's law holds approximately. G. S.

Jones and Allen's "Colour Demonstration of the Dissociating Action of Water." JOEL H. HILDEBRAND (*J. Amer. Chem. Soc.*, 1908, **30**, 1914—1916).—Jones and Allen (Abstr., 1896, ii, 467) have described an experiment to demonstrate the dissociating action of water. To a few drops of phenolphthalein diluted with alcohol, a little aqueous ammonia is added. On diluting the solution with water, a red coloration is produced, which disappears on adding a further quantity of alcohol. It is now shown that other indicators, namely, litmus, *p*-nitrophenol, and rosolic acid, do not behave in this manner with alcohol, and it is suggested that the decolorisation of phenolphthalein by alcohol is not due to a decrease in the dissociation of the ammonia, but results from a combination of the alcohol with the colourless form of the phenolphthalein. E. G.

Diffusion in Colloidal Media. A. V. DUMANSKI (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 210—212*).—The diminution of area of the cross-section of a solution which results from the presence of a colloidal substance causes a diminution in the rate of diffusion of dissolved substances. The effect is similar to that already found for the diminution of the electrical conductivity of electrolytes in presence of gelatin (compare Abstr., 1907, ii, 841).

If the dissolved substances are soluble in the colloid, this plays a positive part in the diffusion process. An equation is deduced for the general case in which diffusion takes place through the liquid medium and also through the colloidal particles. The experimental data for the diffusion of sodium chloride, sodium sulphide, and methylene-blue through solutions of gelatin and agar-agar indicate that the diffusion of these substances through the colloids takes place very slowly.

H. M. D.

Studies on Capillarity and Adsorption. Method for Determining the Concentration of Dilute Solutions of Mineral Acids. I. HOLMGREN (*Biochem. Zeitsch.*, 1908, **14**, 181—208).—When a drop of an aqueous solution of hydrogen chloride (less than

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* and *J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1579—1583.

1%) is placed on filter or blotting-paper, the acid spreads itself out in the form of a circle, but is always surrounded by a wider circle of water, and the more dilute the original acid solution the greater is the difference in the diameters of the two circles. It is found that for two given solutions the percentages of acid present are in the same ratio as the quotient $\frac{\text{area of paper moistened by acid}}{\text{area of periphery moistened by water}}$.

On this relationship, the author has based a method for determining the concentrations of very dilute solutions of hydrogen chloride when only a very small volume (0·05 c.c.) of the solution is available.

Nitric, sulphuric, and phosphoric acids react in much the same manner, but they are not adsorbed by the paper so readily as hydrochloric acid.

The method of carrying out the determination is to select a blotting-paper of suitable quality, to draw on this a fine line with a 1% solution of Congo-red, and to mark off on this, by fine cross-lines, millimetres. When the drop of acid solution is added, the diameters of the two circles can be read off easily after a short time. The constant K for the paper can be first determined by using solutions of acid of known concentration, and afterwards the concentration of any solution can be calculated by means of the formula: $P = r^2k/R^2 - r^2$, where $P =$ the percentage concentration of the acid, K is the constant for the paper, r is the radius of the acid drop, and R is the radius of the larger drop (acid and water).

The solution should be added slowly from a pipette, so that it does not simply flow over the surface of the paper, but distributes itself by means of capillary attraction.

The actual amounts of liquid used can be varied within limits without affecting the results; as a rule, drops from 6—24 mm. radius were used, but the best results were obtained with a radius of 10—12 mm.

Similar results are obtained when the lower end of a strip of paper is immersed in the solution, and the heights to which the acid and the water rise are measured. The results calculated from the equation $P = h.k/H - h$, where h is the height of the acid and H is the total height to which the water and acid rise, are, however, not so concordant.

Preliminary experiments indicate that in the latter type of experiment the solution of acid in the paper above the solution is more concentrated than the solution in the vessel below. It is shown that the concentration of the solution in the paper is equal to the original concentration of the solution + the constant for the paper: $P_1 = P + K$.

J. J. S.

Nature of Adsorption. HERBERT FREUNDLICH (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 212—220).—A critical consideration of the theories which have been brought forward to account for the phenomena of adsorption. The charactoristic phenomena are tabulated, and it is shown that the curves which express the dependence of the quantities of adsorbed substances on the concentration of these in the medium with which the adsorbent is brought into contact, cannot be reconciled with the assumption that the phenomena are regulated simply by the law of chemical mass action. The fact that the adsorption of chemically very different substances is regulated by the same numerical constants is also unexplainable on any simple chemical theory. On the other hand, the observed facts can be reconciled without difficulty with the view that adsorption is a surface condensation phenomenon. The cause of such surface condensation is supposed to be the differentiation of the layers at the surface of contact of two media in consequence of a modification in the resultant action of the intermolecular forces. The recent measurements by Lewis (Abstr., 1908, ii, 357) of the change of surface tension with the concentration at the surface of contact of an aqueous solution of sodium glycocholate and a hydrocarbon oil, and of the corresponding adsorption, are considered to lend support to the surface condensation theory. The fact that the adsorbed qualities of sodium glycocholate are very much greater than those required by the thermodynamic formula, is attributed to the invalidity of certain assumptions which are involved in the deduction of the formula. H. M. D.

Robertson's Theory of Adsorption. KARL LANDSTEINER (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 221—224).—In reference to Robertson's paper (Abstr., 1908, ii, 818), the author discusses the applicability of the theory of adsorption to explain the observed facts of immunochemistry. H. M. D.

Adsorption and its Connexion with Enzyme Action. WILLIAM M. BAYLISS (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 224—226). —A correction of certain statements attributed to the author by Robertson (Abstr., 1908, ii, 818), and a criticism of the latter's attempt to explain adsorption phenomena on the basis of the law of mass action. H. M. D.

Adsorptive Power of the Hydroxides of Silicon, Aluminium, and Iron. PAUL ROHLAND (*Zeitsch. anorg. Chem.*, 1908, 60 366—368. Compare Abstr., 1907, ii, 957).—Dry, finely-powdered clay, after agitating with solutions of alkali carbonates, removes all carbonate ions from the solution. Other ions are not removed in the same way. The disappearance is attributed to the colloidal dissolution and subsequent coagulation of metallic hydroxides from the clay, followed by adsorption. C. H. D.

Freezing of Hydrosols. ALFRED LOTTERMOSER (*Ber.*, 1908, 41, 3976—3979. Compare Abstr., 1907, ii, 851).—Recently prepared hydrosols of silicic acid or of ferric hydroxide which contain an appreciable quantity of ions do not become flocculent by freezing and subsequent thawing, and their specific conductivity remains unchanged. If submitted to dialysis before freezing, gelatinisation does occur, and the more readily the smaller the ionic concentration becomes; the specific conductivity diminishes, *pari passu*, with the elimination of the electrolyte, becomes nil, and finally begins to increase again. These results serve to explain the behaviour of liquor ferri dialysati, aluminium acetate, and sodium silicate (compare Bobertag, Feist, and Fischer, Abstr., 1908, ii, 1024).

In the author's opinion the precipitation of a colloid by the freezing of its hydrosol is conditioned by the complete solidification of the solution to a crystalline mass. This is true, not only with sols, but also with certain (apparently) dry gels. For example, the gel of silicic acid, dried as completely as possible between filter paper, is cooled for a long time in ice and salt, and then brought to the ordinary temperature, when a large quantity of water separates, and small, apparently crystalline, glistening leaflets form on the walls of the vessel. The author conceives, and intends to test, the theory that the enormous pressure exerted by the water in solidifying causes the particles of the colloid to arrange themselves between the faces of the ice crystals, whereby they assume a leaf-like structure. C. S.

Freezing of Hydrosols. Alexander Gutbier and Ferdinand Flury (*Ber.*, 1908, **41**, 4259—4260. Compare Abstr., 1902, ii, 653; 1904, ii, 613; Bobertag, Feist, and Fischer, Abstr., 1908, ii, 1024; Lottermoser, preceding abstract).—The authors do not agree with Lottermoser's conclusion that the formation of gel from a hydrosol by the process of freezing depends on the complete solidification of the mass. J. J. S.

Solubility in Mixed Solvents. VII. Walter Herz and F. Kuhn (*Zeitsch. anorg. Chem.*, 1908, **60**, 152—162. Compare Abstr., 1908, ii, 569).—The solubility of mercuric chloride, bromide, iodide, and cyanide, of potassium iodide, of sodium bromide and iodide, and of ammonium chloride and bromide, has been determined in mixtures in varying proportions of methyl and propyl alcohols, of ethyl and propyl alcohols, and (when not previously measured) of methyl and ethyl alcohols, as well as in the pure solvents, at 25°, and the results are given in tabular form. The density and viscosity of the solutions have also been determined.

The solubility in the pure solvents diminishes as the molecular weight of the alcohol increases.

For mixtures of ethyl and propyl alcohols, the observed values are in all cases within 10% of those calculated on the assumption that the components exert their effect independently. For the mixtures of which methyl alcohol is a component, however, the difference between the observed and calculated values is greater than 10% in ten cases out of eighteen. The deviations are greatest for potassium iodide, ammonium chloride, mercuric chloride, and mercuric cyanide, and may be positive or negative. It is known that mercuric chloride enters into chemical combination with methyl alcohol, but the cause of the deviation from additive behaviour in the other cases is not known. G. S.

Influence of Substitution in the Components on the Equilibrium of Binary Solutions. III. Robert Kremann [with Erwin Benesch, Willy Decolle, P Dolch, K. Kaas, F. Pilch, and F. Scherenziss] (*Monatsh.*, 1908, **29**, 863—890. Compare Abstr., 1906, ii, 268).—The freezing-point curves for mixtures of benzene and phenanthrene with isomeric di- and tri-nitrobenzenes and di- and tri-nitrotoluenes have been determined.

According to these, benzene does not form compounds with any of the isomeric dinitrobenzenes, nor with 1 : 2 : 4-, 1 : 2 : 6-, and 1 : 3 : 4-dinitrotoluene.

No compounds are formed by phenanthrene with *o*- and *m*-dinitrobenzene, but with *p*-dinitrobenzene the freezing-point curve indicates the formation of a compound containing 3 mols. of phenanthrene and 1 mol. of *p*-dinitrobenzene. The curve corresponding with the compound extends from 70 to 77 mols. % phenanthrene, and is limited by eutectics at 79·5° and 79° respectively.

With the above trinitrotoluenes, phenanthrene yields no compounds, but with trinitrobenzene and trinitrotoluene, compounds containing equimolar quantities of the components are indicated by the curves. The compounds melt respectively at 125° and 87·5°. In the case of trinitrobenzene, the curve for the compound extends from 17 to 84·5 mols. % phenanthrene, the corresponding eutectic temperatures being 104° and 85·5°.

In the case of trinitrotoluene, the curve for the compound extends from 18 to 70 mols. % phenanthrene, the eutectic temperatures being 69° and 70°.

A comparison of the results with those previously obtained for naphthalene leads to the conclusion that of the hydrocarbons with one, two, and three benzene rings, naphthalene most readily yields compounds with the dinitro-benzenes and -toluenes. H. M. D.

Chemical Affinity. III. Solution-affinity of Binary Systems. I. Theoretical. J. N. Brönsted (*Zeitsch. physikal. Chem.*, 1908, 64, 641—656. Compare Abstr., 1906, ii, 339, 834).—A mathematical paper. The phenomena of miscibility, like those of chemical combination, are very closely related to the thermal constants of the system.

In the first place, equations representing the relations between the solution-affinity, A, and the concentration, and between the heat given out on mixing, U, and the concentration for binary mixtures, are deduced, and the relative positions of the A and U curves are shown. Equations are then obtained showing the variation of the heat of admixture and the solution-affinity respectively with the temperature.

The solution-affinity may be represented by the equation :

$$A = a + bT - bT\log_e T - cT^2 - \tfrac{1}{2}dT^3 - \ldots\ldots + kT,$$

where k is the affinity-constant of admixture. For "ideal" solutions (in which $U = 0$), both dilute and concentrated, the differential affinity constants k_1 and k_2, for the two components are given by the equations $k_1 = -R\log_e x$ and $k_2 = -R\log_e(1-x)$ respectively, where x represents the concentration of one of the components in unit quantity of the mixture. The case of non-ideal solutions, when U is not zero, is then considered, and it is shown that the separation of a homogeneous solution into two layers with increase of temperature is to be expected when the heat-capacity increases when solution takes place. Finally, formulæ are given showing how the solution-affinity may be deduced from measurements of the partial vapour pressure of the components, from measurements with galvanic cells, and also from the freezing-point curves with the help of thermal data.

The application of these results to concrete cases will be made in a subsequent paper. G. S.

Determination of the Rate of Chemical Change by Measurement of the Gases Evolved. F. E. Everard Lamplough (*Proc. Camb. Phil. Soc.*, 1908, 14, 580—608).—A more detailed account of work which has already been published (Proc., 1906, 22, 280; 1908, 24, 29). W. H. G.

Formation and Decomposition of Ammonia by the Silent Electric Discharge in a Siemens Tube, with Particular Reference to the Validity of the Law of Mass Action. John H. Davies (*Zeitsch. physikal. Chem.*, 1908, 64, 657—685).—The greater part of the work described in this paper has already been published (Le Blanc and Davies, Abstr., 1908, ii, 653. Compare Pohl, *ibid.*, 819). The velocity constant for the decomposition of ammonia is approximately a linear function of the current strength. The velocity of decomposition is practically independent of the frequency of the alternating current.

Starting with a mixture of nitrogen and hydrogen in the ratio 1 : 3 by volume, the equilibrium mixture contains 3% of ammonia, that is, 6% of the possible amount of ammonia is formed, and the same equilibrium point is reached on starting with pure ammonia. The maximum amount of ammonia at equilibrium is obtained when the gases are taken in the above ratio. The rate of formation falls off very rapidly, in other words, the greater part of the ammonia is formed during the first period of passing the current. The velocity of formation increases somewhat with increase in the current-strength. G. S.

The System Water, Ammonium, Barium, and Cupric Chlorides. Frans A. H. Schreinemakers (*Chem. Weekblad*, 1908, 5, 847—852. Compare Abstr., 1908, ii, 1020).—The author has employed his method of representing a quaternary system by means of a regular tetrahedron to represent the system water, ammonium, barium, and cupric chlorides. He finds that double salts sometimes behave as though they contained a single component, and sometimes as though they were composite. A. J. W.

Induction by Ferrous Salts of Interaction of Chromic and Hydriodic Acids. Ross A. Gortner (*J. Physical Chem.*, 1908, 12, 632—646).—A continuation of the work of Benson (Abstr., 1904, ii, 316).

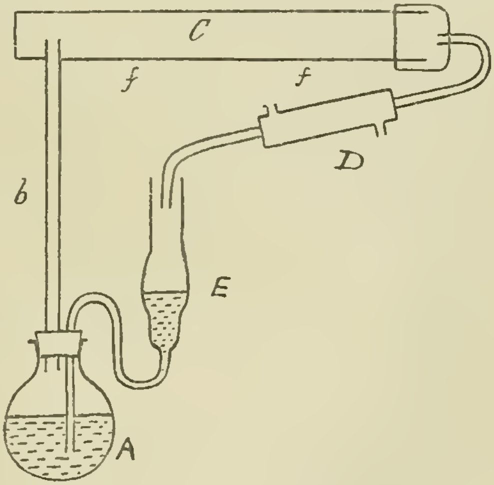
The rate of liberation of iodine is reduced by the presence of an alkali chloride, bromide, or fluoride, but the ferrous iron is more rapidly oxidised in presence of the halogen salt. Alkali sulphates, and also agar-agar, have no effect on the velocity; egg-albumin and colloidal ferric hydroxide somewhat reduce it, and ferric salts have a marked retarding effect.

The liberation of iodine at 0° is more rapid than at 30°, because the ferrous salt is more rapidly oxidised at the latter temperature. The influence of concentration of various reagents is held to support the view that both Fe'' and FeI'' are undergoing oxidation in the solution.

R. J. C.

An Improved Method of Esterification. G. E. Gibson (*Proc. Roy. Soc. Edin.*, 1908, 28, 703—704. Compare Abstr., 1905, i, 852). —The author describes an apparatus whereby the method of preparing esters described by Taylor (*loc. cit.*) is rendered a continuous process.

C is a wrought iron tube 50 cm. long and of 5 cm. internal diameter; it is closed at one end, and fitted at the other end with a screw cap, which carries a tube connexion to the condenser, *D*. The condenser tube fits loosely into a glass syphon, *E*, of capacity about 150 c.c., the lower end of which passes through a cork and terminates well under the liquid contained in flask *A*. *C* and *A* are connected by the tube *b*, which projects about 1 cm. into *C*. All the joints, with the exception of *D* to *E*, are air-tight. The tube *C* is loosely packed with lumps of quicklime, and *A* is charged with the acid to be esterified, mixed with excess of alcohol, about 100 c.c. of benzene, and a few drops of concentrated hydrochloric acid. Two small gas flames are placed at *f*, *f*, and when the tube *C* is heated sufficiently to prevent condensation of alcohol or benzene, the flask *A* is heated on a steam-bath. As the liquid in *A* boils, the vapour of the ternary mixture, alcohol, benzene, and water (b. p. 68°), passes into *C* where it is deprived of the water, whilst the mixed vapour of alcohol and benzene pass on, are condensed by *D* and returned to the flask by the syphon *E*.



It is claimed that this method is applicable to all cases where Taylor's method may be used, and, as an indication of the efficiency of this process, figures are given showing that pure ethyl tartrate may be prepared in quantities which are more than 90% of the theoretical yield.

J. V. E.

Kinetics of the Formation and Saponification of the Esters of Nitrous Acid. Waldemar M. Fischer (*Zeitsch. physikal. Chem.*, 1908, 65, 61—69).—Ethyl nitrite reacts so rapidly with water that the rate of reaction cannot be measured. In very dilute aqueous solution, when hydrolysis is complete (1 mol. in 500 litres), the nitrous acid in the ester can therefore be titrated like the free acid. The equilibrium mixture of acid, alcohol, ester, and water contains very little ester; $K = [\text{alcohol}][\text{acid}]/[\text{ester}][\text{water}]$ is about 0·012 at 0°. The rapid formation of ethyl nitrite in aqueous solution is partly conditioned by the relative insolubility of the ester in water, and its consequent removal from the system.

The velocity of saponification of ethyl nitrite by alkalis, both in aqueous and absolute alcoholic solution, is of the same order as that of other esters. It is hydrolysed by sodium hydroxide in aqueous solution about three times as rapidly as ethyl acetate under corresponding conditions, and about one-tenth as rapidly as the latter by sodium ethoxide in absolute alcohol.

The mechanism of ester formation in this case is discussed. Although the reaction is very rapid, it is probably not an ionic reaction, but proceeds through the formation of an unstable intermediate compound of acid and ester (Baeyer and Villiger).

G. S.

Esterification. I. Victor Meyer's Esterification Law. Martin A. Rosanoff and W. L. Prager (*J. Amer. Chem Soc.*, 1908, 30, 1895—1907).—In accordance with Victor Meyer's law (Abstr., 1894, i, 463), aromatic acids, in which both positions next to the carboxyl group are occupied by substituting groups, cannot be esterified by means of alcohol and acid. It has been found, however, that such acids can be readily esterified by simply heating them at high temperatures with ethyl alcohol, or even by prolonged warming at the temperature of the water-bath. The esterification law must therefore be modified as follows: "Aromatic acids with one or both positions next to the carboxyl occupied by substituting groups combine with alcohols more slowly, although to no less extent, than acids otherwise constituted."

A form of the mass law is presented in which the volumes of the reacting substances are taken into account, and is recommended for employment in kinetic studies generally.

The equilibrium and velocity constants of the esterification of several acids by ethyl alcohol have been determined, with the following results. Acetic acid, at the ordinary temperature, $K = 4$, $k = 0·00061$; 2 : 4 : 6-trichlorobenzoic acid, at 183°, $K = 0·105$, $k = 0·031$; 2 : 4 : 6-tribromobenzoic acid, at 183°, $K = 0·42$, $k = 0·088$; 2 : 3 : 5-tribromobenzoic acid, at 183°, $K = 0·12$, $k = 0·37$; 3 : 4 : 5-tribromobenzoic acid, at 183°, $K = 0·30$, $k = 0·90$; benzoic acid, at 183°, $K = 0·40$, $k = 0·63$. From these results, it is seen that the velocity constant of 2 : 4 : 6-tribromobenzoic acid is about one-fourth of that of the 2 : 3 : 5-tribromo-acid, and one-tenth of that of the 3 : 4 : 5-tribromo-acid. The steric hindrance hypothesis is shown to be untenable by the fact that the velocity constant of the di-ortho-substituted trichlorobenzoic acid, instead of being greater, is much smaller than that of the corresponding tribromo-acid.

2 : 3 : 5-*Tribromobenzoic acid*, m. p. 193·5°, forms yellow crystals.

E. G.

Esterification. II. W. L. Prager (*J. Amer. Chem. Soc.*, 1908, 30, 1908—1914).—Rosanoff and Prager (preceding abstract) have shown that Victor Meyer's steric hindrance hypothesis and esterification law are untenable.

This conclusion is now confirmed by a study of the esterification of α-nitrophthalic acid with ethyl alcohol at 183°, which has given $K = 1·58$ and $k = 0·20$.

The investigation has been extended to aliphatic acids, and the following values have been obtained at 183°. Acetic acid, $K = 4·0$, $k = 1·48$; propionic acid, $K = 2·24$, $k = 0·95$; *iso*butyric acid, $K = 2·10$, $k = 10·7$; αα-dimethylpropionic acid, $K = 2·0$, $k = 0·18$. The following values of k are derived from an application of the mass laws to Lichty's results (Abstr., 1896, ii, 557) on the esterification of the chloroacetic acids at 80°. Chloroacetic acid, 2·46; dichloroacetic acid, 6·38, and trichloroacetic acid, 12·0. These results do not accord with the steric hindrance hypothesis. *iso*Butyric acid undergoes esterification more rapidly than propionic acid, whereas the reverse should be the case. Moreover, the velocity constants of the chloroacetic acids, even at 80°, are greater than that of acetic acid at 183°, and increase with the number of chlorine atoms near the carboxyl group, which is in direct opposition to the requirements of the steric hindrance hypothesis.

The electric dissociation constants of these acids are quoted, and it is shown that an increase in the esterification constants is accompanied by an increase in the dissociation constants.

It is shown that the large differences between the esterification constants of mono-ortho-substituted aromatic acids and those of acids with the two ortho-positions free, enable a separation of acids of the former class from other acids to be effected by a process of esterification.

E. G.

Esterification, Hydrolysis of Esters, and Formation of Salts with Arylacetic Acids and Some of their Derivatives. Joseph Gyr (*Ber.*, 1908, 41, 4308—4322. Compare Sudborough and Feilmann, Proc., 1897, 241; Sudborough and Lloyd, Trans., 1898, 73, 81; 1899, 75, 467; Menschutkin, Abstr., 1881, 883).—The work of Bistrzycki and his pupils has resulted in the convenient preparation of tertiary aromatic acids. The introduction of phenyl groups into acetic acid decreases the strength of the acid, unlike the introduction of chlorine, which increases the strength. Further, these substituted acetic acids are more difficult to esterify, and the inquiry was instituted in the hope that a systematic comparison of the different arylacetic acids would throw some light on these properties. Methyl alcohol was chosen, as Menschutkin has already shown that the velocity of esterification at the start of the reaction is greater than with the others (this Journ., 1877, ii, 865; Abstr., 1879, 36). The alcohol was carefully dehydrated over calcium (this vol., i, 2), as traces of water depress the constant. The solution was $N/10$ both as regards organic acid and the catalytic hydrochloric acid, the temperature employed was 25°, and the constant determined from the equation $K = 1/t \log a/a - x$. Acetic acid was esterified 50% during two minutes, phenylacetic acid during five minutes, diphenylacetic acid in one and a-half hours, and triphenylacetic acid not even after one hundred hours. Below are given the constants found during the inquiry, the initial constant being in all cases higher than those found later in the experiment.

	K.		K.
Acetic acid	7·758	Chloroacetic acid	2·355
Phenylacetic acid	3·566	Phenylchloroacetic acid	0·445
Diphenylacetic acid	0·202		
Triphenylacetic acid	0·000503	*p*-Tolylacetic acid	3·752
		Phenyl-*p*-tolylacetic acid	0·221
p-Hydroxyphenylacetic acid	3·979	Diphenyl-*p*-tolylacetic acid	0·000175
p-Hydroxydiphenylacetic acid	0·205	Glycollic acid	9·859
		Mandelic ,,	3·098
p-Hydroxytriphenylacetic acid	0·000339	Benzilic ,,	0·0177

In every instance there is a very large decrease in the esterification constant when the phenyl group is introduced.

The hydrolysis of the esters was carried out in methyl alcohol distilled over sodium, as Kremann has shown that small quantities of water have only a slight effect on the hydrolysis constant (Abstr., 1905, ii, 307). The solutions again used were $N/10$; $aK = 1/t\ X/a - X$.

	aK.		aK.
Methyl acetate	0·0102	Methyl triphenylacetate	—
,, phenylacetate	0·0178	,, diphenyl-*p*-tolylacetate	—
,, diphenylacetate	0·0031		

The introduction of one phenyl residue actually raises the constant; the triaryl esters are very stable.

The following salts of triphenylacetic acid have been prepared: the *ammonium*, $C_{20}H_{19}O_2N,1\frac{1}{2}H_2O$?, easily hydrolysed by water, *potassium*, $C_{20}H_{15}O_2K,1\frac{1}{2}H_2O$, *barium*, *strontium*, and *copper*. The *ammonium*, $C_{21}H_{21}O_2N,H_2O$, *sodium*, *potassium*, *barium*, and *lead* salts of diphenyl-*p*-tolylacetic acid have also been obtained.

A convenient method of preparing phenyl-*p*-tolylacetic acid by condensing mandelic acid and toluene in the presence of tin tetrachloride is described.

W. R.

Chemical Composition of Matter. Eduard Mulder (*Rec. trav. chim.*, 1908, 27, 418).—It is suggested that Daltonian atoms contain smaller atoms, that the latter are again composite, and so on indefinitely. The final, infinitely small atoms are supposed to be beyond conception.

R. J. C.

Explanation of the Periodic System of the Elements on the Basis of the Electron Theory. Hugo Strache (*Ber. deut. physikal. Ges.*, 1908, 6, 798—803).—A theoretical paper in which an attempt is made to explain a large number of different phenomena on the assumption that the atoms are aggregates of corpuscles which are identical with electrons and with the particles which constitute the ether. The distance separating two corpuscles determines the nature of their mutual action, that is to say, whether they attract or repel one another. The nature of the action of an atomic aggregate on the ether particles is supposed to determine the electro-positive or -negative character, the valency, and other properties of the atoms. Corresponding with the periodic system, the nature of this mutual action varies in a periodic manner as the atomic aggregates increase in complexity. H. M. D.

New Periodic Function of the Atomic Weight. Viktor Pöschl (*Zeitsch. physikal. Chem.*, 1908, 64, 707—708).—When the proportions of the elements present on the earth are plotted against their respective atomic weights, a periodic curve is obtained. G. S.

Filter Holder. Robert Hansen (*Chem. Zentr.*, 1908, ii, 1145; from *Apoth. Zeit.*, 1908, 23, 652).—An arrangement is described for holding the folded filter paper in a funnel so as to leave a free space of about 6 mm. between the holder and the funnel. It is made of tinned iron with an aperture at the bottom for the filtrate to flow through, and will fit all kinds of funnels. Besides hastening filtration, it obviates the necessity of accurately folding the filter paper to fit a particular funnel. J. V. E.

Filter Funnel and Funnel Strainer. Ernst Pessler (*Chem. Zentr.*, 1908, ii, 1145; from *Apoth. Zeit.*, 1908, 23, 659).—The author describes a conical aluminium filter-paper holder to be placed in the ordinary funnel; it is perforated from the apex to the rim at the top by small holes, and has, in addition, several points which rest on the funnel and keep a space of about ½-cm. between the funnel and the strainer.

The aluminium funnel strainer described is made with a bevel edge so as to fit closely to the funnel; it is perforated by one millimetre holes, and is designed to replace the older form, in which the sieve is soldered to the funnel. J. V. E.

A Stirrer for Vacuum-Distillation Flasks. H. Süchting (*Zeitsch. anal. Chem.*, 1908, 47, 755—756).—The stirrer is constructed as follows: A glass tube, 5 mm. in diameter and about 850 mm. in length, is fixed through the rubber stopper closing the neck of the flask, the lower end of the tube projecting about 50 mm. below the stopper. A wide tube about 100 mm. in height is fixed to the long tube just above the stopper, and the space between the two is partly filled with mercury. A second long tube is passed over the first, its lower end dipping in the mercury, and its upper end being fixed by means of a piece of rubber tubing to a glass rod passing down the centre of the first tube into the flask; at the bottom of the rod is fixed a stirring device. Short pieces of tubing held in clamps serve as bearings for the outer long tube, and the latter is rotated together with the rod by means of a pulley and motor. When the air is exhausted from the flask, the mercury rises in the space between the two tubes until the barometric height is reached. W. P. S.

Distillation and Rectification of Alcohol. (Lecture Experiment.) Eduard Donath (*Chem. Zentr.*, 1908, ii, 1001—1002; from *Zeitsch. chem. Apparat.*, 1908, 3, 360—362).—Beer containing 3 to 4% of alcohol is boiled in a flask and the vapour led by means of a tube into a second flask, where a liquid condenses having 12 to 15% of alcohol; if a third flask is attached to the second one in a similar manner so as to condense the issuing vapour, a spirit is obtained of sufficient strength to burn. The principle of rectifying spirit is also shown by having as a condenser a series of copper vessels with outside copper jackets, so that water at various temperatures may be made to circulate round them. A third form of apparatus for demonstrating this process is described, where the vapour from boiling beer or other dilute spirituous liquid is led into a condensation vessel from which vapour still passes on through a tower fitted with frequent layers of metallic gauze, thence through a series of water-cooled bulbs, and, finally, the issuing vapour is condensed. A liquid containing 58 to 60% vol. of alcohol is obtained by this method. J. V. E.

Inorganic Chemistry.

Hydrate of Iodine Oxyfluoride, Fluoroiodates, and Iodoxyfluorides. Rudolf F. Weinland and Ferdinand Reischle (*Zeitsch. anorg. Chem.*, 1908, 60, 163—172. Compare Weinland and Lauenstein, Abstr., 1899, ii, 363).—*Iodine oxyfluoride hydrate*, $IOF_3,5H_2O$ or $IF_3(OH)_2,4H_2O$, is obtained in colourless needles by dissolving iodic acid in a solution of hydrofluoric acid in glacial acetic acid and evaporating. The same compound, contaminated with iodine, is obtained when alcohol is used as solvent. The crystals fume in the air, giving off hydrogen fluoride.

Four salts containing pyridine have also been prepared. When 1 mol. each of iodic acid and pyridine are dissolved in an acetic acid solution of hydrofluoric acid and the solution evaporated over sulphuric acid, *pyridine trifluoroiodate*, $IF_3(OH)_2,C_5NH_5$, separates in colourless, prismatic needles. When a concentrated aqueous solution of this salt is allowed to crystallise slowly, *pyridine difluoroiodate*, $IF_2O(OH),C_5NH_5$, is obtained in colourless crystals. When the pyridine salt first mentioned is dissolved in a mixture of hydrofluoric acid and glacial acetic acid, and 1 mol. of iodic acid is added, *pyridine pentafluorodi-iodate*, $IF_2O(OH),C_5NH_5,IOF_3,H_2O$, is obtained. Finally, from a solution of 2 mols. of iodic acid, 1 mol. of pyridine, and excess of hydrofluoric acid in alcohol, *pyridine heptafluorodi-iodate*, $IF_4(OH),C_5NH_5,IOF_3$, is obtained in colourless needles. All the pyridine salts are stable in air.

The following five compounds are obtained by dissolving the corresponding iodo-compounds (iodobenzene and the iodotoluenes) in very concentrated alcoholic hydrofluoric acid. *Phenyl iodoxyfluoride hydrofluoride*, $C_6H_5\cdot IOF_2,HF$, the *p*-bromo-derivative,

$$C_6H_4Br\cdot IOF_2,HF,$$

and o-, m-, and p-*tolyliodoxyfluoride hydrofluoride*, $C_6H_4Me\cdot IOF_2,HF$, all form colourless crystals, which readily give up hydrogen fluoride. The *compound*, $IOF_3,C_6H_5\cdot IOF_2$, separates in colourless needles from a solution of 1 mol. of iodobenzene and 3 mols. of iodic acid in alcoholic hydrofluoric acid; it is readily decomposed by water. G. S.

Ozone. III. STEPHAN JAHN (*Zeitsch. anorg. Chem.*, 1908, **60**, 292—336. Compare Abstr., 1905, ii, 16; 1906, ii, 292).—The sources of error in measurements of the electrical potential of ozone are discussed. The velocity of rotation of the electrode is without influence, and the anomalies are therefore not to be explained by diffusion (compare Luther and Inglis, Abstr., 1903, ii, 406). The effect is shown to be probably due to the adsorption of ozone by platinum.

Measurements of potential were made against hydrogen with platinum electrodes in sulphuric acid, with and without the addition of cobaltic sulphate. The results show that over the interval where Co‴ forms 2·5—8·0% of the total Co, the potential of the cell corresponds closely with that required by the ratio Co‴ : Co″. When Co‴/Co″ = 1, the potential is 1·785 volt, a value employed in calculating the ozone potential.

The *E.M.F.* of a cell in which the reaction $O_3 + H_2 = H_2O + O_2$ occurs, is probably 1·90 volt at 0°.

An equation is given by means of which the temperature-limits of stability of ozone may be determined, derived from the Gibbs-Helmholtz equation, but the uncertainty of the values for potential and for specific heat is so great that no accurate calculation can be made. It appears, however, that ozone should be formed from oxygen by the action of heat alone in quite measurable quantity at a temperature of 2000° (compare Fischer and Marx, Abstr., 1906, ii, 224, 606).

C. H. D.

Ozone. IV. STEPHAN JAHN (*Zeitsch. anorg. Chem.*, 1908, **60**, 337—357. Compare preceding abstract).—The development of heat in the decomposition of ozone has been measured by a method similar in principle to that of van der Meulen's, soda-lime being employed as catalyst, and a current of ozonised oxygen of constant composition led through the calorimeter. The catalyst was contained in a glass tube connected with a copper spiral tube in a vacuum-jacketed vessel.

The heat of dissociation of ozone is found to be 34,100 cal. per gram-molecule, with a probable error of 1%. C. H. D.

Investigation of the System: Sulphur–Iodine. F. OLIVARI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 512—521).—The freezing-point curve of mixtures of sulphur and iodine is of the type of a cryohydric curve, the eutectic point, corresponding with 80·8 atom % of sulphur, being at 65·7°. The formation of compounds by fusion of these two elements is hence excluded, the supposed melting point of the two iodides, S_3I_2 and S_2I_2, being the cryohydric point.

Cryoscopic measurements of sulphur dissolved in iodine show that the molecular weight has the value 256, corresponding with S_8 in dilute solution, but increases as the concentration is raised; there is therefore no isomorphism between the two elements. The specific volume curve for mixtures of sulphur and iodine is a straight line joining the specific volumes of the two elements. The supposed iodides, S_2I_2 and SI_6, obtained by crystallisation from solution, are mechanical mixtures of sulphur and iodine, as also is probably the iodide, S_3I_2. T. H. P.

Absolute Sulphuric Acid: its Preparation from Sulphur Trioxide and Water: its Specific Electrical Conductivity and that of more Dilute Acid. David M. Lichty (*J. Amer. Chem. Soc.*, 1908, 30, 1834—1846).—During a study of the decomposition of oxalic acid by sulphuric acid (Abstr., 1907, ii, 445), it was observed that the rate of decomposition was decreased to a surprising extent by the addition of only 0·01% of water to sulphuric acid supposed to be of 100% strength. Since analytical methods are not sufficiently accurate to determine the presence of very small quantities of water, recourse was had to determination of the specific electrical conductivity of the acid. This method, however, could not serve to establish the composition of the acid, since the exact conductivity of any one concentration was not known.

A method has therefore been devised for the preparation of absolute sulphuric acid by the direct interaction of sulphur trioxide and water in stoicheiometrical proportions. The specific conductivity of the acid obtained in this way has been determined at 25°, and found to be 0·01041 reciprocal ohm, which is also the minimum specific conductivity of concentrated sulphuric acid. It has also been found that the maximum f. p. of concentrated sulphuric acid is identical with the f. p. of the absolute acid, namely, 10·43—10·45°. It is proved, therefore, that the preparation of absolute sulphuric acid may be based on the minimum specific conductivity and on the maximum f. p.

It is shown that, for acid of not less than 95% strength, the results of analysis by means of conductivity determinations are accurate to within 0·01%. A table of specific conductivities is given, which may be used for analytical purposes. E. G.

Mixed Anhydrides of Sulphuric Acid. Amé Pictet and Georges Karl (*Bull. Soc. chim.*, 1908, [iv], 3, 1114—1126; *Arch. sci. phys. nat.*, 1908, 26, 437—454).—In preparing the mixed anhydride of nitric and sulphuric acids, $(SO_3)_4N_2O_5$, already described (Abstr., 1907, ii, 758), there is also formed some *sulphonitrous anhydride*, $(SO_3)_5(N_2O_3)_2$, m. p. 198—200°, b. p. 302—305°/728 mm., which is better prepared by dissolving sulphur trioxide and nitrogen trioxide separately in carbon tetrachloride and mixing the two solutions. It is a hard, colourless substance crystallising in needles. Its properties are very similar to those of the nitryl tetrasulphate described previously, and, like the latter, it gradually liquefies, but does not fume in moist air. Since Provostaye's nitrosyl sulphate (*Ann. Chim. phys.*, 1840, [ii], **73**, 362) has m. p. 217—230° and distils at 360°, according to various authors, it is suggested that it cannot have the formula, $(SO_3)_2N_2O_3$, generally assigned to it, but should probably be represented as $(SO_3)_6(N_2O_3)_3$.

D'Arcy's observation (Trans., 1889, **55**, 157), that boron and sulphur trioxides do not combine when heated together in open vessels, is confirmed, but combination takes place when the operation is carried out in a closed vessel, *boryl sulphate*, $SO_2(O{\cdot}BO)_2$, being formed at 115—120°, *boryl disulphate*, $(SO_3)_2,B_2O_3$, at 230°, and mixtures of the two at intermediate temperatures. Both are colourless, amorphous, bulky, brittle, hygroscopic substances, which have no definite melting point, do not fume in moist air, but dissociate when heated, leaving eventually residues of boron trioxide. They dissolve in water, yielding solutions of boric and sulphuric acids. Boryl disulphate reacts with alcohol to form alkyl borates and alkyl-sulphuric acids. In the last respect, its behaviour differs somewhat from that of other mixed anhydrides (compare Friedel and Ladenburg, *Compt. rend.*, 1865, **64**, 84; Pictet and Geleznoff, Abstr., 1903, i, 309, 601; Pictet and Bon, Abstr., 1906, i, 3).

When chromium trioxide and sulphur trioxide are heated in closed tubes at 75° or at a higher temperature, a yellow mass of the *mixed anhydride*, SO_3,CrO_3, is formed, together with some chromium sesquioxide, from which it could not be separated. T. A. H.

Molecular Weight of Selenium. F. OLIVARI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 389—391).—Cryoscopic measurements of solutions of selenium in iodine (compare Timmermans, Abstr., 1906, ii, 429) give for the molecular weight of selenium the values 150·2—167·7, the number calculated for Se_2 being 158·4; thus selenium has the molecular weight corresponding with Se_{10} at 4° (compare Beckmann, Abstr., 1904, ii, 235), with Se_8 at 42° (compare Beckmann and Pfeiffer, Abstr., 1897, ii, 363), and with Se_2 at 113·9° (compare also Pellini and Pedrina, Abstr., 1908, ii, 833). T. H. P.

Volumetric Composition of Gaseous Ammonia and Atomic Weight of Nitrogen. PHILIPPE A. GUYE and A. PINTZA (*Compt. rend.*, 1908, **147**, 925—928).—Ammonia prepared from pure ammonium chloride and lime was decomposed by a hot platinum wire, and the nitrogen and hydrogen obtained were passed, after purification, into a vacuous vessel of about 3½ litres capacity until the pressure was about one atmosphere at 0°. The loss in weight of the complete generating apparatus being known, the weight and density of the mixed gases could be calculated. One litre of the mixed gases at 0° and 760 mm. was found to weigh 0·37989 gram when corrected for traces of sulphur dioxide and trioxide. Knowing the densities of hydrogen and nitrogen, and making allowance for their slight expansion on mixing, the volumetric ratio of nitrogen to hydrogen in ammonia is 1 : 3·00172. It follows that the atomic weight of nitrogen is 14·014 (O = 16).

Consideration of the sources of error, however, showed that any value from 14·002 to 14·022 might well have been obtained. The authors consider their method less accurate than direct gravimetric determinations. R. J. C.

Oxidation of Ammonia by Potassium Permanganate and the Effect of Ammonium Salts on the Reaction. Mordko Herschkowitsch (*Zeitsch. physikal. Chem.*, 1908, 65, 93—96).—Dilute solutions of ammonia and of potassium permanganate, in varying concentrations, with or without the addition of ammonium salts, have been heated for definite periods in a large flask at 40°, and the relative proportions of nitrogen, nitrous and nitric acids in the mixture determined.

Increase in the proportion of ammonia increases both the nitrogen and the nitrous acid, and diminishes the nitric acid; increasing the concentration of both reagents has much the same effect, except that the proportion of nitrous acid is not much altered. Addition of ammonium salts diminishes the amounts of nitrogen and nitrous acid, and greatly increases the nitric acid. Ammonium salts are formed in the course of the reaction, even when none are present originally, and, in order to eliminate their action, experiments have been made in which excess of alkali is added previously. In these circumstances, less nitrous acid and more nitrogen are formed. G. S.

The Hydrazinates of some Metallic Salts. Hartwig Franzen and O. von Mayer (*Zeitsch. anorg. Chem.*, 1905, 60, 247—291).—Hydrazinates of metallic salts have been prepared by Curtius and Schrader (Abstr., 1895, ii, 10) and by Hofmann and Marburg (Abstr., 1899, i, 486). A number of new methods of preparation are now described. On the addition of hydrazine to a solution of a cobalt-ammine salt, reduction always takes place, nitrogen being evolved, and the hydrazine compound of a cobaltous salt being precipitated.

One mol. of hydrazine replaces 2 mols. of ammonia. The double compounds form crystalline powders, insoluble in water, soluble in acids or ammonia. Sulphates and nitrates tend to combine with 3 mols. of hydrazine, whilst chlorides, bromides, and oxalates, with the exception of nickel chloride and bromide and of calcium and strontium bromides, retain only 2 mols. The following compounds have been prepared:

With $3N_2H_4$: Nickel chloride, bromide, sulphate, nitrate, and dithionate; cobaltous sulphate and nitrate; zinc nitrate; cadmium nitrate; calcium bromide; strontium bromide.

With $2N_2H_4$: Nickel chloride, bromide, and oxalate; cobaltous chloride, bromide, and oxalate; zinc chloride, bromide, iodide, oxalate, and sulphate; cadmium chloride, bromide, iodide, oxalate, sulphate, carbonate, and phosphate; ferrous chloride and oxalate; manganous chloride, sulphate, and nitrate; cupric oxalate; calcium chloride and nitrate; strontium chloride; barium chloride and bromide.

Full analyses and descriptions of the compounds are given.

C. H. D.

Chlorine Azide [Chloroazoimide], N_3Cl. FRITZ RASCHIG (*Ber.*, 1908, **41**, 4194—4195).—*Chloroazoimide*, N_3Cl, is liberated as a colourless gas, having an odour similar to hypochlorous acid, when an aqueous solution of sodium azoimide (1 mol.) and sodium hypochlorite (1 mol.) is acidified even with weak acids, such as acetic acid or boric acid. It is slightly soluble in water, forming a yellow solution, and explodes with extraordinary violence when brought into contact with a flame or glowing splinter, and sometimes spontaneously with the production of a pale blue flame. It is decomposed by aqueous sodium hydroxide, thus: $N_3Cl + 2NaOH = NaN_3 + NaOCl + H_2O$.

W. H. G.

Preparation of Crystalline Silicon. A. J. KIESER (*Chem. Zeit.*, 1908, **32**, 1161—1162).—With the object of ascertaining whether combination takes place between aluminium and silicon when methods involving the use of aluminium are employed for preparing silicon, careful tests have been made for aluminium in the silicon and for silicates in the slag. For the first tests, crystalline silicon was prepared by Vigouroux's method, and for the second the slag from Wöhler's method was examined. In each case the quantity of aluminium and silica respectively obtained was so small as to make it evident that combination between aluminium and silicon does not take place.

J. V. E.

New Formation of Liquid Alloys of Potassium and Sodium. GEORGE F. JAUBERT (*Bull. Soc. chim.*, 1908, [iv], **3**, 1126—1131; *Ber.*, 1908, **41**, 4116—4120*).—The liquid alloys obtained by the action of (1) sodium on potassium hydroxide and (2) potassium on sodium hydroxide are described.

When sodium hydroxide is melted in a vacuous Jena flask with potassium, reaction occurs at 200—250°, bubbles of gas (hydrogen?) are evolved, the temperature rises to 300°, and a layer of the alloy, NaK_2, having the appearance of mercury is formed and floats on the excess of alkali hydroxide used.

When potassium hydroxide (6 parts) and sodium (11 parts) are melted together in the same way at 250—275°, the alloy, NaK, is formed, but by modifying the quantities of the hydroxide and metal used and raising the temperature to 350°, the chief product is the alloy, NaK_2. Both alloys are liquid, and do not solidify even at 10°. They oxidise rapidly in cold air, especially if fresh surfaces are continually exposed, and even when kept under liquid petroleum the potassium slowly oxidises. The alloy, NaK_2, is now made commercially, and is being applied in a number of industries.

T. A. H.

Cæsium Chromates. FRANS A. H. SCHREINEMAKERS and D. J. MEYERINGH (*Chem. Weekblad*, 1908, **5**, 811—816).—The following chromates of cæsium have been prepared (at 30°): Cs_2CrO_4; $Cs_2Cr_2O_7$; $Cs_2Cr_3O_{10}$, and $Cs_2Cr_4O_{13}$. Their properties are similar to those of the corresponding chromates of potassium, ammonium, and rubidium. The mono- and di-chromates dissolve in water without decomposition;

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* and *Ann. Chim. anal.*, 1909, **14**, 1—5.

the tri- and tetra-chromates are decomposed by water. The solubility of the monochromates of ammonium, potassium, rubidium, and cæsium increases in the order given; that of the dichromates diminishes in the same order.
A. J. W.

Action of Carbon Dioxide under Pressure on Metallic Hydroxides at 0°. Frank K. Cameron and William O. Robinson (*J. Physical Chem.*, 1908, 12, 561—573).—The authors have determined the solubility of carbon dioxide in water at various pressures in presence of an excess of the solid hydroxides or carbonates. Successive small quantities of carbon dioxide were forced into a tube containing the hydroxides or carbonates, vigorously stirred with a small known weight of water, and curves were obtained connecting pressure with weight of carbon dioxide in the apparatus. Breaks in these curves at any pressure indicate absorption of carbon dioxide by the solid phase, that is, the formation of solid carbonates or hydrogen carbonates.

The only authentic solid hydrogen carbonates appear to be those of the alkali metals, excluding lithium. Calcium, ferrous iron, and magnesium do not form solid hydrogen carbonates at 0° even under 5 atmospheres pressure. The hydroxides of aluminium, ferric iron, and glucinum do not appear to combine with carbonic acid.

The authors regard the solubility of calcium carbonate in carbon dioxide solution as due to a specific solvent action of the carbon dioxide-water mixture rather than as indicating the formation of a hydrogen carbonate (compare, however, Raikow, Abstr. 1905, ii, 85).
R. J. C.

The Solvent Action of Carbon Dioxide up the Carbonates of the Heavy Metals. Clarence A. Seyler (*Analyst*, 1908, 33, 454—457).—It has been shown by Free (Abstr., 1908, ii, 848) that the solubility of basic copper carbonate increases with the concentration of the free carbon dioxide, and the author now shows that Free's results exhibit regularities similar to those found for other carbonates, and that these can be deduced from the principles of chemical equilibrium. The solubility of the basic carbonates of zinc and lead is governed by the same law. In all three cases the effect of a hydrogen carbonate would be to diminish the solubility, according to the law $\sqrt{M} \times HCO_3 =$ constant, when the carbon dioxide is kept constant. The protective action of calcium in solution as hydrogen carbonate on waters which act on lead and zinc is thus explained.
W. P. S.

Mixed Barium-Strontium Chromate Precipitate. Lionel H. Duschak (*J. Amer. Chem. Soc.*, 1908, 30, 1827—1833).—Hulett and Duschak (Abstr., 1904, ii, 616) have stated that the occlusion of barium chloride by precipitated barium sulphate is most easily explained by regarding the precipitate as an isomorphous mixture of barium sulphate with one or more complex barium salts, and that cases of isomorphism in which one component, owing to its ready solubility, is present in only a minute quantity are probably not uncommon.

A study has now been made of the precipitate of mixed barium and strontium chromates formed as an intermediate product in the separation of barium and strontium by the usual analytical method. The results of the experiments show that a crystalline precipitate of barium and strontium chromates of definite composition is formed in a saturated solution of barium chromate containing given concentrations of strontium chromate and acetic acid. It has been found that diffusion takes place within this substance, and that, therefore, it must either be regarded as a solid solution or else diffusion must be recognised as a possible property of isomorphous mixtures.

E. G.

Silico-thermic Experiments. PAUL ASKENASY and CHARLES PONNAZ (*Zeitsch. Elektrochem.*, 1908, **14**, 810—811).—Barium peroxide and silicon react very violently when the reaction is initiated by means of a fuse. By using coarsely-powdered barium peroxide (50 parts) and silicon (15 parts), a barium silicide with 30% of barium is obtained. The mixture (with less silicon and a little sodium peroxide) may also be used to fuse iron or copper, or powdered ferro-silicon or titanium silicide may be used in place of silicon.

T. E.

Estimation of the Valency of Glucinum by Colloidal Experiments. ANT. GALECKI (*Zeitsch. Elektrochem.*, 1908, **14**, 767—768).—The quantities of barium, calcium, potassium, glucinum, magnesium, lanthanum and aluminium salts required to coagulate a colloidal solution of arsenic sulphide are compared. Glucinum behaves in exactly the same way as barium, calcium, and magnesium, very much larger quantities of potassium salts and very much smaller quantities of aluminium or lanthanum salts being required to produce the same effect. The results point to glucinum being bivalent.

T. E.

Compounds of Lead with Nitrous Acid. ALBERTO CHILESOTTI (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 377—384, 474—483. Compare Abstr., 1908, ii, 948).—When treated with water, the basic salt, $Pb(OH)_2,Pb(NO_2)_2,H_2O$, undergoes hydrolysis, yielding the compound $3PbO,N_2O_3,xH_2O$ (*loc. cit.*). The latter then undergoes further hydrolysis, during which the ratio $Pb:NO_2$ increases to a value indicating the formation of the salt $4PbO,N_2O_3,H_2O$.

The experiments carried out up to the present time show that the following basic salts must be regarded as definite compounds: $Pb(OH)_2,Pb(NO_2)_2$, and its hydrate with $1H_2O$; $3PbO,N_2O_3$ or $2PbO,Pb(NO_2)_2$, and $4PbO,N_2O_3,H_2O$; the first two of these salts may be regarded as derivatives of ortho-nitrous acid, H_3NO_3.

The salt $3PbO,N_2O_3$ may be prepared as follows: The basic salt, $Pb(NO_2)_2,Pb(OH)_2,H_2O$, is treated with increasing quantities of water, the limpid, yellow solution formed being replaced by water, by which means an almost colourless, turbid liquid is obtained, from which the suspended substance is gradually deposited; the substance then remaining undissolved consists of the salt $3PbO,N_2O_3,xH_2O$.

Study of the electrolysis of the salt $4PbO,N_2O_5,N_2O_3,3H_2O$ in dilute acetic acid shows that the ions NO_2' or the molecules of the neutral nitrite, $Pb(NO_2)_2$, do not form complex cations with lead, and that the ions NO_3' and NO_2' move, for the most part, independently of one another, and in proportions corresponding with the stronger dissociation of $Pb(NO_3)_2$ and with the greater mobility of the NO_3' ion; the current is carried only in small proportion by lead ions.

In order to ascertain whether lead nitrate combines with the nitrite in small proportion to form complex anions, the author uses a method devised by Miolati and Pizzighelli (Abstr., 1908, ii, 595). Conductivity measurements of solutions containing lead nitrite and nitrate show that the specific conductivity curve changes direction when the two salts are present in molecular proportions. It is hence probable that, to a certain small extent, these two salts combine in the proportion $Pb(NO_3)_2 : Pb(NO_2)_2$ to form a complex salt.

Attempts to separate such a complex salt in the solid state from solutions containing the components in molecular proportions were unsuccessful. T. H. P.

Optical Investigation of the Copper Complex in Ammonia and Pyridine Solutions. ARTHUR HANTZSCH and PHILIP WILFRED ROBERTSON (*Ber.*, 1908, **41**, 4328—4340. Compare Abstr., 1908, ii, 447, 646).—The method previously described has been extended to the coppertetrammine complex, and the following conclusions have been arrived at. All cupric compounds whether in aqueous or alcoholic ammonia solutions are optically identical, and contain exclusively the coppertetrammine complex, $Cu(NH_3)_4$; the base is coppertetrammine hydrate, $Cu(NH_3)_4(OH)_2$, and not the diammine hydrate. The colour is not materially altered whether the temperature, degree of dissociation, or solvent is changed, and apparent departures from this are ascribed to chemical change; as for example the formation of a triammine-aquo-complex, $Cu^{(NH_3)_3}_{(OH_2)}$. The solutions in aqueous pyridine of copper salts are likewise identical; the complex is less stable than that with ammonia, and is probably $Cu^{Py_3}_{OH_2}$. Copper acetate in pure or alcoholic pyridine contains another, less intensely coloured, complex, probably $Cu^{Py_2}_{(OAc)_2}$.

The chemical influence of the solvent is exhibited in the water and methyl, ethyl, and amyl alcoholic solutions of copper acetate, probably due to the addition of solvent to the unsaturated complex, $Cu(OAc)_2$. Copper forms in solutions only the complex CuR_4, and has co-ordination number 4. W. R.

Scandium. SIR WILLIAM CROOKES (*Phil. Trans.*, 1908, **209**, *A*, 15—46. Compare Abstr., 1908, ii, 695).—About thirty scandium salts, both of inorganic and organic acids, have been prepared and analysed, and their properties are described in detail. Some of the inorganic salts have already been described by previous observers.

The chloride, Sc_2Cl_6, and the corresponding bromide crystallise with $12H_2O$; the fluoride is anhydrous. Scandium potassium sulphate,

$Sc_2(SO_4)_3,3K_2SO_4$, is, contrary to the statement of Cleve, and in agreement with Nilson, only slightly soluble in a saturated solution of potassium sulphate. The *selenate*, $Sc_2(SeO_4)_3,8H_2O$, rhombic prisms, loses $6H_2O$ at 100°, and becomes anhydrous at 400°; it decomposes at a yellow heat. The nitrate, $Sc(NO_3)_3,4H_2O$, prismatic crystals, is rendered anhydrous on heating over a water-bath, and decomposes at a high temperature. When dried in a vacuum at 100° for seventeen hours, a basic nitrate, $Sc(OH)(NO_3)_2,H_2O$, is obtained, and another basic nitrate, $Sc_2O(NO_3)_4$, is obtained by heating the nitrate for twelve hours in a hot-air oven at 120°.

The majority of the organic scandium salts were prepared by interaction of scandium hydroxide and the corresponding acid. Most of the salts with fatty acids are more soluble in cold than in hot water. The *formate*, $(HCO_2)_2Sc\cdot OH,H_2O$, occurs in hard, lustrous crystals, soluble in hot water and in alcohol. The *acetate*,

$$(C_2H_3O_2)_2Sc\cdot OH,2H_2O,$$

forms fine white crystals, which, on being kept for some days, lose $1H_2O$. The *propionate*, $(C_3H_5O_2)_2Sc\cdot OH$, occurs as a voluminous, white powder, easily soluble in alcohol; the *butyrate*, $(C_4H_7O_2)_2Sc\cdot OH$, the iso*butyrate*, with $2H_2O$, and the iso*valerate*, $(C_5H_9O_2)_2Sc\cdot OH,2H_2O$, are also amorphous and soluble in alcohol.

Scandium oxalate, $Sc_2(C_2O_4)_3,5H_2O$, occurs as a crystalline powder, which loses $2H_2O$ over sulphuric acid at the ordinary temperature, $3H_2O$ in air at 100°, and $4H_2O$ in air at 140°. It is moderately soluble in a solution of ammonium oxalate, on which fact a method of separating scandium from other rare earths may be based. The *succinate*, $C_2H_4[CO_2Sc(OH)_2]_2,H_2O$, is a white powder, insoluble in water and alcohol; the *picrate*, $(C_6H_2O_7N_3)_2Sc\cdot OH,14H_2O$, occurs in yellow, needle-shaped crystals, which explode faintly on heating. The salt loses $9H_2O$ at 100°. The *benzoate*, $(C_6H_5\cdot CO_2)_3Sc$, and the o-*toluate*, $(C_6H_4Me\cdot CO_2)_2Sc\cdot OH,3H_2O$, form crystalline powders; a *basic* o-*toluate*, $2C_8H_7O_3Sc,Sc(OH)_3$, obtained by using excess of the hydroxide, occurs as a white powder. The m- and p-*toluates*, both with $3H_2O$, form white, curdy precipitates, insoluble in water; the *phenylacetate*, $(C_7H_7\cdot CO_2)_2Sc\cdot OH,3H_2O$, is also practically insoluble in water. The *pyromellitate*, $C_6H_2[CO_2Sc(OH)_2]_4,2H_2O$, a white, amorphous powder, loses $1H_2O$ at 100°, and the remaining molecule at 140°. The *camphorate*, $C_{10}H_{14}O_4{:}ScOH$, is a white, insoluble powder, which is very electrical in the dry state.

The atomic weights of the closely-related elements, scandium yttrium, and ytterbium, are approximately simple multiples of that of boron, and as they occur together in nature, it is suggested that the elements of lower atomic weight may be formed from those of higher atomic weight by successive sub-division.

Photographs of those parts of the spectrum containing the more prominent scandium lines are given. G. S.

Scandium. I. RICHARD J. MEYER (*Zeitsch. anorg. Chem.*, 1908, 60, 134—151).—The extraction of scandium from wolframite (from Zinnwald, Saxony) is described. The mineral contains 0·14—0·16% of rare earths, in which scandium oxide predominates. The ore is first fused with sodium hydroxide and extracted with water; the residue (chiefly the oxides of iron, manganese, calcium, and lead) contains practically all the scandium (0·30—0·33% of the oxide).

Two methods have been used for separating the scandium from the mixed oxides: (1) To a neutral or slightly acid solution of the oxides a saturated solution of oxalic acid is added, and the mixture kept for twenty-four hours. The precipitate, which is richer in the rare earths than the original mixture, is washed, ignited, dissolved in excess of hydrochloric acid, and excess of hydrofluoric acid is added. The precipitate thus obtained is quite free from manganese, and consists of the fluorides of lead, calcium, iron, and of the rare earths. The remaining metals are removed by special methods, and the rare earth residue finally obtained contains about 95% of scandium oxide.

According to the second method, the mixture of oxides is dissolved as completely as possible in hydrochloric acid, solid sodium silicofluoride is then added, and the mixture boiled for half an hour, when a precipitate containing all the scandium and practically none of the other rare earths is obtained. Iron, calcium, etc., are then removed as before, and, finally, a very pure scandium oxide is obtained.

The other rare earths, except thorium, can be separated from scandium by adding sodium thiosulphate to a neutral solution and boiling for some time; the precipitate consists of scandium thiosulphate. The final product was tested for purity spectroscopically and by an atomic weight determination; it contained about 1% of thorium oxide, for which no quite satisfactory method of separation has been found. G. S.

Heats of Combustion of Aluminium, Calcium, and Magnesium. Frank E. Weston and Henry R. Ellis (*Trans. Faraday Soc.*, 1908, 4, 130—133).—Both magnesium and calcium reduce aluminium oxide on ignition with a fuse; magnesium also reduces lime. Lime and magnesia are partly reduced by aluminium and calcium respectively at high temperatures. C. H. D.

Aluminium Carbide. Paul Askenasy, W. Jarkowsky, and A. Waniczek (*Zeitsch. Elektrochem.*, 1908, 14, 811—813).—When pure crystalline aluminium carbide is heated above the melting point of aluminium in air or in an indifferent gas, metallic aluminium exudes from it. In making the carbide from alumina and carbon in the electric furnace, the best yield of carbide is obtained by rapidly cooling the contents of the furnace. When the cooling is slow, the product consists mainly of the apparently unchanged mixture. The authors believe that the reaction $Al_4C_3 \rightleftharpoons 4Al + 3C$ has a transition point; at high temperatures the carbide is the stable system, at lower temperatures it decomposes into the metal and carbon. At the melting point of aluminium, the velocity of decomposition is very considerable. These observations explain the presence of hydrogen in the gas evolved by the action of acids on aluminium carbide, and also the fact that a copper-aluminium alloy is formed when it is fused with copper. T. E.

Fused Alumina in the Amorphous State, and Reproduction of Blue Colour of Sapphires. Louis Paris (*Compt. rend.*, 1908, 147, 933—935).—Pure alumina in the oxyhydrogen flame, although it is only superficially fused, absorbs chromic oxide throughout its mass, giving artificial rubies. Oxides of cobalt, iron, etc., which would give a blue coloration, are insoluble in pure alumina. Nickel oxide, however, dissolves, giving a greenish-blue colour.

If a small percentage of another oxide, such as lime, is added to the fused alumina, cobalt and other colouring oxides dissolve, giving a blue product, the optical properties of which show it to be amorphous, whereas pure alumina and artificial rubies are crystalline.

Stones, weighing as much as 20 carats, can be obtained indistinguishable from natural sapphires, except by a slight difference in refractive index. R. J. C.

Reproduction of the Blue Colour of Oriental Sapphires. Auguste Verneuil (*Compt. rend.*, 1908, 147, 1059—1061).—The author contends that the process described by Paris (preceding abstract) does not accurately reproduce the colour of Oriental sapphires. W. O. W.

Alum. Robert Marc (*Zeitsch. anorg. Chem.*, 1908, 60, 193—207). —Whilst a specimen of alum obtained from Kahlbaum had a solubility in water of about 10 grams per litre at 17°, being independent of the degree of supersaturation before cooling, and it readily formed supersaturated solutions, a specimen obtained from Merck was less soluble, had very little tendency to form supersaturated solutions, and the solubility depended on the degree of supersaturation before the excess of salt was caused to separate by inoculation; the higher the supersaturation the greater the final solubility. It was then found that the alum which separated from dilute solutions contained more alkali, that is, it was more basic than that separating from more concentrated solutions. The original alum of Merck, however, was of the usual composition, as was that of Kahlbaum.

No adequate explanation of these phenomena has so far been found. Of the commercial alums examined, only Merck's showed the peculiarity in question. G. S.

Solidification Curves of Certain Molten Silicates. Emil Dittler (*Monatsh.*, 1908, 29, 1037—1074).—The freezing-point curves for mixtures of ægirite and nephelin, labradorite and nephelin, and labradorite and diopside, have been determined. Comparative measurements were made for mixtures of the minerals and of the artificial substances. In general, the melting-point curves for mixtures of the artificial products are higher than those for the minerals. The melting points of the crystalline mixtures lie in all cases approximately on a straight line, whilst in the case of the glasses the melting points are considerably lower than those of the two components. The order in which the silicates separate out is: magnetite, augite, ægirite, labradorite, diopside, nephelin, and sodium augite. This succession is in agreement with Rosenbusch's rule.

The experimental data lead the author to doubt whether the solidification of complex silicate mixtures is even approximately regulated by the factors which determine the same process in the case of simple systems. H. M. D.

Action of Hydrochloric Acid on Permanganates. Rudolf F. Weinland and P. Dinkelacker (*Zeitsch. anorg. Chem.*, 1908, **60**, 173—177).—Meyer and Best (Abstr., 1900, ii, 77) have obtained double salts of manganese tetra- and tri-chloride with potassium chloride by leading hydrogen chloride into a solution of potassium permanganate in glacial acetic acid. The authors now show that these and corresponding double salts can be obtained by the action of aqueous concentrated hydrochloric acid on permanganates.

The compound, $MnCl_4,2KCl$, is best obtained by adding calcium permanganate and a concentrated solution of potassium chloride to a 40% aqueous solution of hydrochloric acid cooled with ice and salt; it forms small, dark red crystals. The corresponding rubidium and ammonium salts have been obtained in the same way.

From the solutions from which the double salts of quadrivalent manganese have separated, double salts of tervalent manganese of the type $MnCl_3,2KCl$ are obtained on adding excess of the alkali chlorides in concentrated aqueous solution. The *rubidium*, cæsium, potassium, and ammonium salts have been prepared; all except the rubidium salt have been described by previous observers. G. S.

Action of Chlorine on Ferroboride and Manganese Boride at High Temperature. Josef Hoffmann (*Zeitsch. angew. Chem.*, 1908, **21**, 2545—2546).—When Goldschmidt's ferroboride is heated to 300—400° in a long combustion tube in a current of dry chlorine, there is produced near the heated substance a small quantity of a dark green sublimate having the composition Fe_3Cl_9B. The chief product, however, condenses farther away on the cooler parts of the tube as a brown solid, and is probably a complex substance composed of boron chloride and ferrous chloride. A still more volatile compound was condensed in a U-tube connected to the combustion tube and kept in a cooling mixture; this was a pale yellow, highly refractive liquid, b. p. 24—28°, which appears to be impure boron chloride.

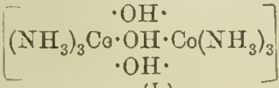
Manganese boride, heated in dry chlorine in a similar manner, also gave complex manganese boro-chlorides, but in such small quantities that at present it has not been possible to ascertain their composition. J. V. E.

Composition of Colloidal Ferric Hydroxy-chlorides. Léopold Michel (*Compt. rend.*, 1908, **147**, 1052—1054. Compare Malfitano, Abstr., 1906, ii, 450).—This paper contains details of the method adopted for studying the composition of colloidal ferric chloride solutions by filtration through collodion membranes. Experiments have been made to determine the ratio Fe : Cl in the micro-cells of ferric hydroxy-chloride to which the membranes are impermeable, and in the filtrate which constitutes the intercellular liquid. From the analytical data obtained, the author arrives at the conclusion that the colloidal solution contains several physical units of variable composition.

In one series of experiments carried out on an ochreous solution of ferric chloride containing a precipitate, the intercellular liquid was found to be of uniform composition throughout. The micro-cells suspended in the top layer contained iron and chlorine in the atomic ratio Fe : Cl = 2·4 : 1, whilst in the lower layer containing the sediment the ratio was 4·5 : 1.

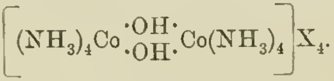
In the stable colloidal solution obtained by adding ferric chloride to boiling water, a separation of micro-cells of different composition was effected by means of the centrifuge. W. O. W.

Complex Metal Ammonias. VIII. Transformation of Hexamminetrioldicobalt Salts into Octamminedioldicobalt Salts. ALFRED WERNER (*Ber.*, 1908, 41, 3879—3884. Compare Abstr., 1908, ii, 42, 43).—It has been found possible to pass from a hexamminetrioldicobalt salt having the constitutional formula (I) to an octamminedioldicobalt salt having the formula (II), that is, to replace an "ol-bridge" in the former by 2 mols. of ammonia, and thus obtain further confirmation of the correctness of these formulæ:



$$\left[(NH_3)_3Co\begin{array}{c}\cdot OH\cdot\\ \cdot OH\cdot\\ \cdot OH\cdot\end{array}Co(NH_3)_3\right]X_3.$$

(I.)



$$\left[(NH_3)_4Co\begin{array}{c}\cdot OH\cdot\\ \cdot OH\cdot\end{array}Co(NH_3)_4\right]X_4.$$

(II.)

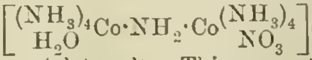
Hexamminetrioldicobalt sulphate (compare this vol., ii, 43) is converted by cold 50% nitric acid into *dinitratohexamminedioldicobalt nitrate*, $[NO_3(NH_3)_3Co(OH)_2Co(NH_3)_3NO_3](NO_3)_2,3H_2O$, which crystallises in pale violet, glistening scales. Its aqueous solutions quickly decompose; consequently, other salts of this series could not be prepared in a pure state. A freshly-prepared solution when treated with sodium dithionate slowly deposits *nitratoaquohexamminedioldicobalt dithionate*,

$$[H_2O(NH_3)_3Co(OH)_2Co(NH_3)_3NO_3]_2(S_2O_6)_3,7H_2O,$$

as small, pale violet scales. An aqueous solution of the nitrate which has been kept for some time, when treated with sodium sulphate, yields *diaquohexamminedioldicobalt sulphate*,

$$[Co_2(NH_3)_6(OH)_2(OH_2)_2](SO_4)_2,4 \text{ or } 3H_2O,$$

an intense, bluish-violet, sparingly soluble salt which could not be obtained pure. The nitrate is converted by liquid ammonia and subsequent treatment with ammonium bromide into octamminedioldicobalt bromide (compare Abstr., 1907, ii, 965). W. H. G.

Complex Metal Ammonias. IX. Decammine-μ-aminodicobalt Salts. ALFRED WERNER (*Ber.*, 1908, 41, 3912—3921. Compare Abstr., 1908, ii, 42).—When octammine-μ-amino-ol-dicobalt nitrate is treated with nitric acid in the cold, *nitratoaquo-octammine-μ-aminodicobalt nitrate*,  $\left[\begin{array}{c}(NH_3)_4\\ H_2O\end{array}Co\cdot NH_2\cdot Co\begin{array}{c}(NH_3)_4\\ NO_3\end{array}\right](NO_3)_4$, is obtained quantitatively as a violet salt. This, on addition in small quantities to well-stirred liquid ammonia, is converted into the decammine-μ-amminodicobalt nitrate, a small quantity of the octammine-

μ-amino-ol-dicobalt nitrate being regenerated. The constitution of this salt was determined independently of the octammine series, as chloropentammine-cobalt and hexammine-cobalt salts are obtained by the action of a mixture of hydrochloric and sulphuric acids, from which the deduction is made that five molecules of ammonia are attached to each of the cobalt atoms, thus: $[(NH_3)_5Co{\cdot}NH_2{\cdot}Co(NH_3)_5]Cl_5 + HCl = \left[Co\begin{smallmatrix}Cl\\(NH_3)_5\end{smallmatrix}\right]Cl_2 + [Co(NH_3)_6]Cl_3$. That the decammine salt is not an imino-derivative of the type $[(NH_3)_5Co{\cdot}NH(HCl){\cdot}Co(NH_3)_5]Cl_4$ is shown by its behaviour towards alkalis, the elements of hydrogen chloride not being withdrawn.

These salts have all a bluish-red colour, and correspond with the rhodochromium salts, $\left[Cr_2\begin{smallmatrix}(NH_3)_{10}\\OH\end{smallmatrix}\right]X_5$, from which the conclusion is drawn that the hydroxyl in the chromium compound plays the same part as the μ-amino-radicle in the cobalt derivatives.

The *nitrate*, $Y(NO_3)_5,\{Y=[(NH_3)_5{\cdot}Co{\cdot}NH_2{\cdot}Co(NH_3)_5]\}$, forms dark bluish-red needles; the *chloride*, YCl_5,H_2O, precipitated from the solution of the nitrate by addition of ammonium chloride, crystallises in glistening, reddish-violet needles, and is not decomposed on boiling with concentrated hydrochloric acid. It is only decomposed by the mixture of sulphuric acid and hydrochloric acid by long-continued heating. The *bromide*, YBr_5,H_2O, forms slender, reddish-violet needles; the *dithionate*, $Y_2(S_2O_6)_5,6H_2O$, forms a rose-red powder, which, on heating at 60—80°, loses $4H_2O$ and is converted into the hexammine and hydroxyl pentammine salts. This was shown by treatment with aqueous ammonium bromide, when the hexammine bromide was precipitated. The filtrate on addition of alcohol deposited a bluish-red powder free from sulphur, which, on boiling with hydrochloric acid, gave chloropentammine-cobalt chloride. The *sulphate*, $Y_2(SO_4)_5,3H_2O$, crystallises in red needles and thin prisms. W. R.

True Peroxide of Nickel. GIOVANNI PELLINI and D. MENEGHINI (*Zeitsch. anorg. Chem.*, 1908, 60, 178—190).—A nickel peroxide of the formula NiO_2,xH_2O has been obtained as follows. A dilute solution of nickel chloride is cooled to $-50°$, an equal volume of 30% hydrogen peroxide added, and, finally, potassium hydroxide in alcoholic solution. The precipitate is washed several times with cold alcohol and then with ether, and forms a greyish-green powder, stable in the air. The pure peroxide has not been obtained, but in one case the ratio Ni : O was as high as 1 : 1·98. The same peroxide is obtained by the action of hydrogen peroxide on free nickel hydroxide, but the reaction is comparatively slow, a large proportion of the hydroxide remaining unchanged. The proportion of water associated with the peroxide has not been determined.

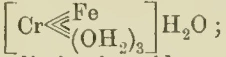
The greyish-green peroxide gives all the reactions of hydrogen peroxide, and its behaviour is quite different from that of the peroxide of the same formula described by Bellucci and Clavari (Abstr., 1905, ii, 823); it is therefore suggested that the former oxide has the constitution $Ni\!<\!\begin{smallmatrix}O\\|\\O\end{smallmatrix}$, and that described by Bellucci, $Ni\!<\!\begin{smallmatrix}O\\ \\O\end{smallmatrix}$. G. S.

Chromium Compounds. VII. Hydrates of Chromium Fluoride and an Example of Co-ordinate Isomerism among Hydrates. ALFRED WERNER and W. COSTACHESCU (*Ber.*, 1908, 41, 4242—4246).—The compounds CrF_3, $CrF_3,4H_2O$, $2CrF_3,7H_2O$, and $CrF_3,9H_2O$ are described in chemical literature.

The authors have examined the compounds with 7 and $9H_2O$, and the following new compounds: $CrF_3,6H_2O$, $2CrF_3,7H_2O$, and $CrF_3,3H_2O$.

Hexaquochromium fluoride, $[Cr(OH_2)_6]F_3$, forms a violet, crystalline powder, and is obtained by adding a concentrated solution of potassium fluoride to a similar solution of violet chromium nitrate. Its electrical conductivity (in paraffin vessels) is about half that of the violet chloride, and treatment with sulphuric acid gives rise to hexaquochromium sulphate. When the moist crystals are kept, they yield the violet hydrate, $CrF_3,9H_2O$. This conversion occurs spontaneously when the crystals are washed, especially when they are pressed slightly with a spatula. This hydrate yields hexaquochromium sulphate when treated with sulphuric acid, and the formula $[Cr(OH_2)_6](OH_2F)_3$ is suggested. The hexahydrate loses $3H_2O$ at 60—70°.

Hexaquochromium chromium hexafluoride, $[Cr(OH_2)_6]CrF_6$, is obtained as an insoluble green product when the hexaquochromium fluoride is warmed with water. A *monohydrate*, $[Cr(OH_2)_6]CrF_6,H_2O$, is obtained by double decomposition between hexaquochromium chloride and ammonium chromium hexafluoride, $(NH_4)_3CrF_6$. It forms a pale green, crystalline powder with a pearly lustre, and when heated at 105° loses a molecule of water, yielding the insoluble green compound. The monohydrate is isomeric with Poulenc's salt (Abstr., 1893, ii, 321), which is regarded as trifluorotriaquochromium monohydrate,



$$\left[Cr\lll\begin{matrix}Fe\\(OH_2)_3\end{matrix}\right]H_2O\,;$$

its aqueous solution has a distinctly acid reaction, but does not give the reactions of fluorides. J. J. S.

Higher Oxidation Products of Chromium. V. Perchromates. ERNST H. RIESENFELD (*Ber.*, 1908, 41, 3941—3951. Compare Abstr., 1908, i, 963).—There are two classes of perchromates: the salts derived from the penta-acid, $HCrO_5$, are blue in colour, those derived from the octa-acid, H_3CrO_8, are red. The salts of chromatodiperacid do not exist (Abstr., 1904, ii, 410, 737).

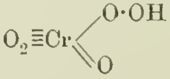
A red, hydrated *potassium perchromate*, analogous to the sodium salt, has been prepared by the action of chromic acid on potassium cyanide in the cold. This salt crystallises in rhombic plates, and very quickly loses its water of crystallisation.

The constitution of these salts has been investigated by determining their molecular weights. The blue pyridine perchromate,

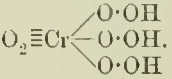
$$C_5H_5N,HCrO_5,$$

is unimolecular, and from determinations of the freezing points in aqueous solution, the red potassium and ammonium perchromates have also the simple formula M_3CrO_8. The solutions are good electrolytes. Determination of the mol.-wt. of the free acid is not possible, because of its rapid decomposition in water; this decomposition has been measured in a mixture of ether, glacial acetic acid, and water, and obeys the unimolecular law. As this argument for the simple formula in the case of the free acid is not conclusive, the electrochemical equivalent of the chromium was determined, and shown to be 1Cr : 6Ag in the case of the red potassium salt. It is not possible to assign a formula to this salt on the assumption of the univalency of potassium, the bivalency of oxygen, and the sexavalency of chromium.

Although hydrogen peroxide cannot be proved to be a product of the decomposition of these salts, yet alkaline gold chloride and permanganate are reduced during the change, and the assumption is made that these salts are analagous to alkali peroxides. The equivalent of permanganate reduced is held to be a measure of the "holoxide" oxygen groups. The blue pyridine perchromate decomposed very rapidly, and so this could not be measured, but in the decomposition of the red salts, 5·5 equivalents of the permanganate were reduced. The conclusion is drawn that this is due to the formation of $3H_2O_2$, and that, therefore, the constitutions of these acids are :



Blue.



Red.

W. R.

Derivatives of Complex Inorganic Acids: Aluminotungstates and Aluminophosphotungstates.

Lloyd C. Daniels (*J. Amer. Chem. Soc.*, 1908, 30, 1846—1857).—Balke and Smith (Abstr., 1904, ii, 179) have described the aluminotungstates, $3(NH_4)_2O,Al_2O_3,9WO_3,4H_2O$ and

$$11Ag_2O,21(NH_4)_2O,4Al_2O_3,36WO_3.$$

The present investigation was carried out with the object of ascertaining whether the ratio $Al_2O_3 : 9WO_3$ would exist in other derivatives. The following salts have been prepared and described,

Copper aluminotungstate, $2CuO,Al_2O_3,9WO_3,16\frac{1}{2}H_2O$; the *barium* salt, $8BaO,Al_2O_3,9WO_3,7H_2O$; the *mercurous* salt, $5Hg_2O,Al_2O_3,9WO_3$, and the *zinc* salts, $1\frac{1}{2}ZnO,Al_2O_3,9WO_3,8H_2O$ and

$$ZnO,Al_2O_3,9WO_3,20H_2O.$$

Ammonium aluminophosphotungstate,

$$9(NH_4)_2O,2Al_2O_3,4P_2O_5,9WO_3,13H_2O ;$$

the *silver* salt, $4Ag_2O,2Al_2O_3,4P_2O_5,9WO_3,6H_2O$; the *barium* salt, $4BaO,2Al_2O_3,4P_2O_5,9WO_3,3H_2O$, and the *zinc* salt,

$$5ZnO,2Al_2O_3,4P_2O_5,9WO_3,11H_2O,$$

are also described.

The following aluminoarsenotungstates have been prepared. The *ammonium* salt, $6(NH_4)_2O,2Al_2O_3,3As_2O_5,18WO_3,14H_2O$; the *barium* salt, $4BaO,2Al_2O_3,3As_2O_5,18WO_3,12H_2O$, and the *cadmium* salt, $4CdO,2Al_2O_3,3As_2O_5,18WO_3,17H_2O$.

A description is also given of the following aluminoantimoniotungstates. The *ammonium* salt,

$$6(NH_4)_2O,2Al_2O_3,3Sb_2O_5,18WO_3,17H_2O ;$$

the *silver* salt, $6Ag_2O,2Al_2O_3,3Sb_2O_5,18WO_3,12H_2O$, and the *barium* salt, $5BaO,2Al_2O_3,3Sb_2O_5,18WO_3,6H_2O$.

E. G.

Compounds of Silicon and Uranium. Uranium Disilicide, USi_2. Édouard Defacqz (*Compt. rend.*, 1908, **147**, 1050—1052.* Compare Abstr., 1907, ii, 475, 696).—The silicides of tungsten and molybdenum of the type MSi_2 having been prepared previously, the author completes the series by describing the preparation and properties of the corresponding uranium compound. *Uranium disilicide*, USi_2, obtained in small yield from silica and the oxide, U_3O_8, by the aluminothermic method, occurs as brilliant microscopic crystals, D^0 8, belonging to the regular system. Chlorine attacks this silicide at 500°, giving the chlorides of uranium and silicon. Cold hydrogen fluoride dissolves it readily, whilst oxidising agents have little action. Although stable in air at a red heat, it burns slowly in oxygen at 800°, and is decomposed on fusion with alkalis, alkali carbonates, or potassium hydrogen sulphate.

Details are given of the method adopted for the analysis of this compound. W. O. W.

Thorium. Werner von Bolton (*Zeitsch. Elektrochem.*, 1908, **14**, 768—770).—The metal is prepared in minute crystals by reduction of the tetrachloride by sodium. By hammering the metal into a thick-walled copper tube 10 mm. in diameter, rolling this down to 1 mm. wire, and removing the copper with dilute nitric acid, a spongy wire of thorium is obtained, which can be rolled out to a band. The melting point is 1450°; it burns in the air; potassium hydroxide and nitric acid have little action; sulphuric acid slowly attacks it, yielding the sulphate, and hydrochloric acid acts quickly, leaving about 15% of the metal undissolved in the form of lower oxides, which are possibly formed during the action. The density of the powder is 11·32, that of the rolled band, 12·16.

When the powder is shaken with cold 5% hydrochloric acid, the first portion which dissolves (about 10% of the whole metal) forms a complex *acid*, $(ThO_2)_{10}(HCl)_4$, the solution of which contains neither thorium nor chlorine ions; its principal reactions are: with oxalic acid or sulphuric acid, a small precipitate, soluble in excess, is produced; ammonium oxalate gives a gelatinous precipitate, insoluble on boiling; ammonium carbonate and citric acid give gelatinous precipitates, insoluble in excess. The metal reduced from this compound is ordinary thorium. T. E.

Thorium. Richard J. Meyer (*Zeitsch. Elektrochem.*, 1908, **14**, 809—810).—The reduction of thorium oxide by carbon tetrachloride yields a metal containing considerable quantities of oxide (Abstr., 1901, ii, 106). The oxide left by Bolton's thorium when dissolved in acid (preceding abstract) was therefore doubtless present in the metal. This also explains the action of dilute hydrochloric acid; the dissolved substance was probably metathorium chloride derived from the oxide. T. E.

Chlorides and Oxychlorides of Thorium. Édouard Chauvenet (*Compt. rend.*, 1908, **147**, 1046—1048. Compare Matignon, Abstr., 1901, ii, 106).—Thorium tetrachloride is most conveniently prepared free from oxychloride by heating thorium dioxide in a current of carbonyl chloride. A deliquescent, white powder, which is formed at the same time, has been proved to be identical with the crystalline chloride by analysis and by measurement of its heat of solution in water (56·75 Cal. at 12·5°). An aqueous solution of the tetrachloride deposits $ThCl_4,7H_2O$ on evaporation (compare Krüss, Abstr., 1897, ii, 456). The heat of dissolution of this hydrate is 14·75 Cal. at 13·5°. When heated at 120—160° in hydrogen chloride, the oxychloride,

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* and *Bull. Soc. chim.*, 1909, [iv], **5**, 3—5.

$$OH{\cdot}ThCl_3,H_2O,$$

is obtained as a very hygroscopic powder, of which the heat of dissolution is 47·63 Cal. at 13·5° (compare Rosenheim, Abstr., 1900, ii, 351). The chloride, $ThCl_4,7H_2O$, is converted into the oxychloride, $ThOCl_2$, at 250°; the heat of dissolution of the latter is 28·15 Cal. at 13°. W. O. W.

Basic Sulphates of Thorium and Cerium. Otto Hauser and F. Wirth (*Zeitsch. anorg. Chem.*, 1908, **60**, 242—246).—Dilute solutions of thorium sulphate deposit flocculent thorium hydroxide, containing some adsorbed sulphate, on boiling; thus resembling zirconium sulphate (Abstr., 1907, ii, 626). Concentrated solutions, heated in sealed tubes at 160—180°, deposit crystals of $ThOSO_4,H_2O$. At 105—115°, the same salt is deposited, mixed with the normal hydrated sulphate.

A dilute ice-cold solution of ceric sulphate deposits, after twenty-four hours, pale yellow crystals of $4CeO_2,3SO_3,12H_2O$, completely analogous to the basic zirconium sulphate. Boiling saturated solutions of ceric sulphate deposit crystals of $2CeO_2,3SO_3,4H_2O$, which, however, could not be obtained in a pure state, since they rapidly redissolve on cooling, and some reduction to cerous sulphate takes place. C. H. D.

Derivatives of Complex Inorganic Acids: Phosphovanadiomolybdates. William Blum (*J. Amer. Chem. Soc.*, 1908, **30**, 1858—1862).—Wolcott Gibbs (Abstr., 1884, 713) described two phosphovanadiomolybdates, $8(NH_4)_2O,2P_2O_5,8V_2O_5,14MoO_3,50H_2O$ and $7(NH_4)_2O,2P_2O_5,V_2O_5,48MoO_3,30H_2O$, and suggested that it was probable that the vanadium pentoxide, considered as $V_2O_2{\cdot}O_3$, might replace the molybdenum trioxide of the phosphomolybdate. He was unable, however, to obtain a salt containing a higher proportion of vanadium pentoxide than that in the first compound mentioned. The present author is of opinion that this was probably due to the fact that an excess of ammonium vanadate was used in all the experiments.

The formation and composition of the ammonium phosphovanadiomolybdates has now been further studied, and the following *compounds* have been obtained: $6(NH_4)_2O,P_2O_5,4V_2O_5,18MoO_3,52H_2O$, and the corresponding silver salt;

$$5(NH_4)_2O,P_2O_5,2\tfrac{1}{2}V_2O_5,21\tfrac{1}{2}MoO_3,50H_2O;$$
$$8(NH_4)_2O,P_2O_5,5V_2O_5,18MoO_3,45H_2O;$$
$$7(NH_4)_2O,P_2O_5,5\tfrac{1}{2}V_2O_5,16\tfrac{1}{2}MoO_3,50H_2O;$$
$$8(NH_4)_2O,P_2O_5,7V_2O_5,15MoO_3,50H_2O,$$

and the corresponding silver salt;

$$8(NH_4)_2O,P_2O_5,8V_2O_5,14MoO_3,50H_2O;$$
$$8(NH_4)_2O,P_2O_5,10\tfrac{1}{2}V_2O_5,11\tfrac{1}{2}MoO_3,50H_2O;$$

and $8(NH_4)_2O,P_2O_5,11V_2O_5,11MoO_3,50H_2O$. All these ammonium salts crystallise in the tetragonal system, and are soluble in water.

E. G.

Action of Antimony Trichloride on Cobalt and on its Alloys with Antimony. F. Ducelliez (*Compt. rend.*, 1908, **147**, 1048—1050. Compare Abstr., 1908, ii, 853).—When cobalt is submitted to the action of antimony trichloride at 700—1200°, *cobalt monoantimonide*, CoSb, is formed as a crystalline, non-magnetic powder, D^0 8·12, m. p. about 1200°. This undergoes slight oxidation in air, and burns readily in oxygen; hydrogen chloride has little action on it, but hot concentrated sulphuric acid dissolves it rapidly. At 700—1450° it attacks antimony trichloride, forming antimony and cobalt chloride; the composition of the residual substance, however, remains unaltered. At 1200°, cobalt is attacked by antimony trichloride, and forms magnetic alloys containing less antimony than the foregoing antimonide; this compound remains as a non-magnetic powder when these alloys are treated with sulphuric acid.

Three classes of alloys of cobalt and antimony have been prepared by direct union of the elements at 500° in a current of hydrogen. (1) Magnetic alloys containing less than 67·04% antimony. When heated with antimony trichloride at 800°, or when treated with sulphuric acid, these lose their magnetic properties, and leave a residue of the monoantimonide, CoSb. (2) Alloys containing 67·04—80·27% of antimony, which decompose readily on heating, and form the monoantimonide when heated at 1200° in hydrogen. Substitution of antimony trichloride for hydrogen gives the same compound, together with antimony and cobalt chloride. (3) Alloys containing more than 80·27% antimony, which, on treatment with nitric acid followed by hydrogen chloride, give *cobalt diantimonide*, $CoSb_2$, a grey, crystalline powder, D^0 7·76, m. p. about 700°; this closely resembles the monoantimonide in its chemical properties.

W. O. W.

Atomic Weight of Bismuth. III. Analysis of Bismuth Bromide. Alexander Gutbier and Hans Mehler (*J. pr. Chem.*, 1908, [ii], **78**, 409—420. Compare Abstr., 1906, ii, 92; 1908, ii, 600).—The bismuth bromide employed in this investigation was prepared by the action of bromine on four specimens of bismuth. The percentage of bromine present in each of the four samples of bromide was determined by dissolving the latter in $2N$-nitric acid and precipitating with silver nitrate. As the result of eight experiments, it was found that 34·81207 grams of bismuth bromide gave 43·80773 grams of silver bromide. The extreme values obtained were $Bi = 208·18$ and $Bi = 207·88$. The value $208·0 \pm 0·06$ ($O = 16$) for the atomic weight of bismuth determined by this method is in agreement with the result ($Bi = 208·0$) obtained by Gutbier and Birckenbach (Abstr., 1908, ii, 600) by the synthesis of bismuth oxide. W. H. G.

Atomic Weight of Bismuth. IV. Synthesis of Bismuth Sulphate. Alexander Gutbier and Rudolf Léon Janssen (*J. pr. Chem.*, 1908, [ii], 78, 421—436. Compare preceding abstract).—The atomic weight of bismuth was determined in this investigation as follows: a known weight of the element was dissolved in nitric acid (D 1·05), the nitrate obtained evaporated with sulphuric acid, and the sulphate heated to constant weight in an electric-oven at 380°. Two specimens of bismuth were used; three experiments with one sample gave the mean value Bi = 208·04, whilst two experiments with the second sample gave Bi = 208·17. The extreme values obtained were Bi = 208·26 and 207·92. The atomic weight of bismuth determined by this method is 208·1 (O = 16).

From the results of the investigations of Marignac (Abstr., 1884, 813), Löwe (Abstr., 1884, 558), Schneider (Abstr., 1895, ii, 114), and of Gutbier and his co-workers, it follows that bismuth has the atomic weight 208·0 (O = 16). W. H. G.

Carbonates and Oxalates of Bismuth. Ludwig Vanino and Emilie Zumbusch (*Ber.*, 1908, 41, 3994—3999).—Attempts to prepare normal bismuth carbonate and oxalate show that these substances are extremely sensitive to the hydrolytic action of water. Only by working under strictly defined conditions can substances of definite composition be obtained. The normal carbonate has not been isolated, but the oxalate is obtained when a solution of bismuth nitrate and mannitol in equal molecular quantities (0·1 gram-mol. per 100 c.c.) is treated at 25° with the calculated quantity of a saturated solution of oxalic acid and the precipitate washed with cold water. If the washing is performed with hot water, the precipitate, after drying, has the composition $OH\cdot Bi\vdots C_2O_4$. C. S.

Mineralogical Chemistry.

Action of Oxidising and Reducing Gases on the Colour of Minerals. Walter Hermann (*Zeitsch. anorg. Chem.*, 1908, 60, 369—404).—A number of coloured minerals have been heated in oxidising and reducing gases in order to determine the nature of the constituent causing colour; borax glasses coloured with known oxides being heated under the same conditions for comparison.

The results indicate that oxides of iron occur as colouring material in zircon, corundum, spinel, epidote, and beryl. Chromium and manganese, together with iron, bring about colorations in green zircon, garnet, and tourmaline. The results with quartz and topaz were indecisive. Organic substances, when present, occur together with metallic oxides, so that, on heating, the colour due to the oxide remains. Certain minerals, halite, fluorite, smoky quartz, amethyst, and citrine, lose their colour when heated in all cases, and this cannot therefore be attributed to oxides of heavy metals.

The colorations are mostly to be regarded as due to dilute solutions of colouring matters, but garnet and epidote are probably coloured in themselves to some extent.

The conditions prevailing in minerals are of a complicated nature.

C. H. D.

Minerals of the Fumaroles of Vesuvius. ALFRED LACROIX (*Bull. Soc. franç. Min.*, 1908, 31, 260—264).—The fumaroles due to the 1906 eruption are still active, and are of two types. Those of one type deposit sodium and potassium chlorides together with cotunnite and tenorite. These saline encrustations contain a rather large quantity of calcium chloride, indicating the presence of the mineral chlorocalcite. The formula of the new mineral palmierite (Abstr., 1897, ii, 628), discovered in these deposits, was given previously as $PbSO_4,(K,Na)_2SO_4$; the published analysis agrees better with the formula $4PbSO_4,3[(K,Na)_2SO_4]$. It is to be noted, however, that the very small amount of material available for analysis was isolated from the associated aphthitalite by dissolving the latter in cold water; but as palmierite is quickly decomposed by hot water and more slowly by cold water, with the separation of lead sulphate, it is probable that the material analysed contained some free lead sulphate, and consequently the true formula of the mineral is more likely to be $PbSO_4,(K,Na)_2SO_4$. Fumaroles of the acid type deposit crystals of erythrosiderite and sassolite.

L. J. S.

Occurrence of Boric Acid in Vesuvianite. EDGAR T. WHERRY and WILLIAM H. CHAPIN (*J. Amer. Chem. Soc.*, 1908, 30, 1684—1687).—Vesuvianite from twenty-five different localities was specially examined for boric acid; in nine cases it was absent, in four present only in traces, and in only four was there more than 1%. The largest amount, 4·14%, was found in the vesuvianite from the Wilui river in Siberia.

F. W. Clarke's formula for vesuvianite is $R_2^{II}Ca_7Al_2(SiO_4)_6$, where R^{II} may be H_2, K_2, Na_2, Mg, Ca, Fe^{II}, Mn^{II}, and especially AlOH and AlF, and Al may be replaced by Fe^{III}, Mn^{III}, or B^{III}. The small amount of ferric iron (never exceeding 5%) present in vesuvianite, however, rather suggests that there is only a limited amount of basic aluminium capable of being replaced by ferric iron, and consequently, that the aluminium and boron play the part of acids. Clarke's formula would then become $Ca_7(R^{II}AlO_2)_2(SiO_4)_2(SiO_3)_4$, or, if part of the aluminium is basic and part acidic, $Ca_7R^{II}(R^{II}AlO_2)(SiO_4)_4(SiO_3)_2$.

L. J. S.

Gibbsite from India. LEWIS LEIGH FERMOR (*Chem. Zentr.*, 1908, ii, 1062; from *Rec. Geol. Survey, India*, 34, 167—171).—Gibbsite occurs in association with manganese ores at Talevadi, in the Belgaum district, Bombay, where it forms a layer 2—6 mm. in thickness on psilomelane in a ferruginous laterite; the small, scaly crystals form greyish-white, radially-fibrous aggregates; anal. I, by S. S. Rama Rau. Anal. II, by J. C. Brown, is of amorphous gibbsite, resembling halloysite in appearance, from Bhekowli, in the Sátará district.

	Al_2O_3.	SiO_2.	H_2O (hygr.).	H_2O (comb.).	Total.	Sp. gr.
I.	63·59	2·01	34·75		100·35	2·40
II.	64·20	0·39	0·62	34·51	99·72	2·35

L. J. S.

Argyrodite from Bolivia. V. Moritz Goldschmidt (*Zeitsch. Kryst. Min.*, 1908, 45, 548—554. Compare Abstr., 1898, ii, 436).—A description is given of some unusually large crystals (3—5 cm. across) of argyrodite found on pyrargyrite from Colquechaca. The habit is dodecahedral {110}, or less frequently octahedral, and the character of the faces, as well as some ill-defined etching-figures, point to holohedral-cubic symmetry, D 6·235. The following analysis agrees with Penfield's formula Ag_8GeS_6.

Ag.	Cu.	Hg.	Fe.	Zn.	Ge.	Sn.	As.	S.	H_2O.	Total.
75·67	0·08	0·03	0·03	0·11	6·55	0·10	0·05	17·15	0·18	99·95

In spite of the difference in crystal-symmetry, argyrodite appears to fall best in the tetrahedrite group, and in this case the formulæ, $3R_2{}^{I}S,R^{III}R^{III}S_3$, for tetrahedrite and, $3R_2{}^{I}S,R_2{}^{I}R^{IV}S_3$, for argyrodite show an analogous homœomorphic relation similar to that between Fe_2O_3, $FeTiO_3$, etc. L. J. S.

Composition of Morinite. Adolphe Carnot and Alfred Lacroix (*Bull. Soc. franç. Min.*, 1908, 31, 149—152).—Morinite, of which a preliminary description was given by Lacroix in 1891, is found in the deposits of tin ore at Montebras, dep. Creuse, as small and indistinct, monoclinic crystals, or more usually as crystalline masses with an easy cleavage and a rose-red colour. It occurs embedded in amblygonite, of which it is an alteration product, and is associated with quartz, cassiterite, and wavellite. Analysis of the massive material gave (after deducting 1·50 SiO_2, 0·20H_2O lost at 120°):

P_2O_5.	F.	Al_2O_3.	Ca.*	Na_2O.	H_2O.	Total.
33·50	13·20	17·80	13·80	5·20	17·90	101·40

* CaO, 19·0; traces of Li_2O, MgO, FeO.

The formula $3AlPO_4,Na_2HPO_4,3CaF_2,8H_2O$, when expressed in the form $(AlF)_3{}^{II}Na_2H(PO_4)_3,(CaF)_3{}^{I}PO_4,8H_2O$, shows in the first molecule a relation to amblygonite, $[Al(F,OH)]^{II}(Li,Na)PO_4$. The alteration of the amblygonite has thus been accompanied by a loss of aluminium and a gain of calcium. The aluminium phosphates, wavellite, and a kind of turquoise are abundant at Montebras, and they represent the last stage in the alteration of the amblygonite. Morinite is remarkable in containing more fluorine than any other phosphate, this element being usually largely replaced by hydroxyl in other minerals.
L. J. S.

Minerals of the Pegmatite-veins with Lithia-tourmaline in Madagascar. Alfred Lacroix (*Bull. Soc. franç. Min.*, 1908, 31, 218—247).—The mineral occurrences in the neighbourhood of Mt. Bity,* in Madagascar, have already been briefly mentioned in connexion with the new species bityite (Abstr., 1908, ii, 705); a more detailed description is now given. Beryl is represented by two varieties: normal beryl, of which the colour is white, blue, or green; and beryl rich in alkalis (cæsium, lithium, and sodium), which is pink.

* *i.e.*, Mt. Ibity, south of Antsirabe.—L.J.S.

The following new analyses are given. Lazulite is found on the surface as dark blue fragments; analysis by F. Pisani gave:

P_2O_5.	Al_2O_3.	MgO.	FeO.	H_2O.	Total.	Sp. gr.
45·30	35·22	9·19	3·95	5·80	99·46	3·12

Another mineral found loose on the surface is doubtfully referred to hatchettolite; this is brown and resinous, with an irregular fracture, transparent in thin flakes, and optically isotropic, D 3·95. A partial analysis by Urbain gave: Cb_2O_5 (with Ta_2O_5 and TiO_2), 56·61; uranium oxide (weighed as U_3O_8), 14·15; GlO, 2·37; Fe_2O_3, 1·13; Mn_3O_4 (with a little cerium and yttrium earths), 1·46; ThO_2, 0·96; SiO_2, 2·31; Pb, Bi, Sn, Cu (weighed as sulphides), 1·52; oxides of alkaline earths, 1·64; loss at 300°, 11·51; loss on ignition, 3·81.

L. J. S.

Alunite from Réalmont, dep. Tarn. PIERRE TERMIER (*Bull. Soc. franç. Min.*, 1908, **31**, 215—216).—The mineral is very compact, and has a pale rose colour with black patches and streaks, the latter being due to the presence of bituminous matter. Analysis by F. Pisani agrees with the usual formula $K_2O,3Al_2O_3,4SO_3,6H_2O$:

SO_3.	Al_2O_3.	K_2O.	CaO.	H_2O.	Insol.	Total.	Sp. gr.
36·80	36·36	10·40	0·76	13·60	2·20	100·12	2·8

The mineral occurs as a stratum, 10 cm. in thickness, between schists and a bed of kaolin, and has evidently been formed by the action of water containing sulphuric acid (derived by the weathering of the iron pyrites in the schists) on a rhyolite rich in orthoclase. The complete separation of these two products of decomposition of the rhyolite into two sharply-defined beds is curious. L. J. S.

The Scheelite of Otago. A. M. FINLAYSON (*Trans. New Zealand Inst.*, 1908, **40**, 110—122).—Scheelite occurs as yellowish-white masses in many of the veins of auriferous quartz in the gold-fields of Otago. Analysis of a commercial sample gave:

WO_3.	CaO.	MgO.	FeO.	Fe_2O_3.	MnO.	CO_2.	Total.
80·58	18·98	0·20	0·24	nil			100·00

Molybdenum is also often present in varying amounts up to 1%. The mineral sometimes occurs in contact with corroded calcite, and has evidently been formed by the action of solutions containing tungstic acid on the lime minerals of the surrounding rocks.

L. J. S.

Tantalite and Gadolinite from Western Australia. ANDREW GIBB MAITLAND (*Chem. Zentr.*, 1908, ii, 1062; from *Bull. Geol. Survey Western Australia*, 23, 65—74).—Mangano-tantalite (hübnerite) occurs as large masses, weighing as much as five hundred weight, in pegmatite-veins traversing greenstone in the Wodgina tin-field, and it is also found in the alluvial deposits; anal. I by Simpson. Gadolinite occurs in granite in the Cooglegong tin-field; anal. II by Davis:

	Ta_2O_5.	Cb_2O_5.	SiO_2.	TiO_2.	Ce_2O_3.	$(La,Di)_2O_3$.	Y_2O_3.	SnO_2.	WO_3.	GlO.
I.	68·65	15·11	—	0·40	—	—	—	0·48	trace	—
II.	—	—	23·33	—	2·50	18·30	33·40	—	—	12·28

	FeO.	MnO.	NiO.	CaO.	MgO.	H_2O.	Loss on ignition (He,H,N,CO_2).	Total.	D.
I.	1·63	14·15	trace	trace	0·15	0·07	—	100·64	7·03
II.	10·38	—	—	—	0·69	—	0·32	101·20	4·14

L. J. S.

Risorite, a New Mineral. Otto Hauser (*Zeitsch. anorg. Chem.*, 1908, 60, 230—236).—The new yttrium columbium mineral from Risör, Norway (Abstr., 1907, ii, 704), has been further examined, and shown to be a definite species. The mean of four analyses gives:

Cb_2O_5.	Ta_2O_5.	TiO_2.	SnO_2.	ThO_2.	UO_2.	$(Y,Er)_2O_3$.	$Ce(La,Di)_2O_3$.
36·21	4·00	6·00	0·01	trace	0·10	36·28	2·88

CaO.	FeO.	PbO.	Fe_2O_3.	Al_2O_3.	CO_2.	N,He.	H_2O.	Total.
1·93	2·61	0·20	1·20	0·81	0·23	0·90	7·11	100·67

It is a glassy, isotropic mass, D^{16} 4·179, hardness 5·5, with considerable β-radioactivity. It may be regarded as an isomorphous mixture of fergusonite with metatitanates. C. H. D.

The So-called Dysanalyte from Vogtsburg, in the Kaiserstuhl. Otto Hauser (*Zeitsch. anorg. Chem.*, 1908, 60, 237—241).—The Kaiserstuhl mineral described by Knop (Abstr., 1878, 385) as dysanalyte appears to consist of perowskite contaminated with enclosures. An analysis of selected crystals gave:

TiO_2.	SiO_2.	Cb_2O_5.	FeO.	CaO.	MnO.	Na_2O.	Ce_2O_3.	Total.
50·93	2·21	4·86	9·22	25·60	0·23	4·37	2·80	100·22

C. H. D.

Naegite. Tsunashirō Wada (*Chem. Zentr.*, 1908, ii, 1063; from *Beiträge zur Mineralogie von Japan*, 1906, 23—25).—A new analysis by Haga of "naegite" (Abstr., 1905, ii, 177) shows that the mineral consists largely of zirconia and silica.

ZrO_2.	ThO_2.	SiO_2.	Cb_2O_5,Ta_2O_5.	UO_3.	Y_2O_3.	Total.
55·30	5·01	20·58	7·69	3·03	9·12	100·73

L. J. S.

[Analyses of Hornblende.] Louis Duparc and Francis Pearce (*Bull. Soc. franç. Min.*, 1908, 31, 94—135).—Numerous determinations are given of the optical constants of several rock-forming minerals, and analyses of the following: (I) hornblende from amphibolite from the Island of Coll, Hebrides; (II) hornblende from amphibolite from Chester, Massachusetts.

	SiO_2.	TiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	Total.
I.	51·50	0·23	2·88	0·14	6·25	5·39	0·05	13·26	16·95	1·61	0·32	98·58
II.	42·74	1·08	5·48	—	11·92	11·46	0·06	12·72	11·60	2·25	0·56	99·69

(I) corresponds with the formula

$$12R_4^{II}Si_4O_{12},3R_3^{II}R_2^{III}Si_3O_{12},2R_2^{I}R_2^{III}Si_4O_{12},$$

and (II) with $10R_4^{II}Si_4O_{12},9R_3^{II}R_2^{II}Si_3O_{12},4R_2^{I}R_2^{III}Si_3O_{12}$. L. J. S.

Zeolites from the Basalt of Montresta, Sardinia. JACQUES DEPRAT (*Bull. Soc. franç. Min.*, 1908, 31, 181—192. Compare Abstr., 1908, ii, 864).—Cavities in the basalt contain heulandito, stilbite, mesolite, chabazite, and rarely analcite and thomsonite. The following were analysed: (I) heulandite, crystals; (II) stilbite, crystals; (III) mesolite, as finely-fibrous, radial aggregates intimately associated with chabazite.

	SiO_2.	Al_2O_3.	CaO.	Na_2O.	H_2O.	Total.
I.	59·00	16·70	8·20	1·30	14·70	99·90
II.	57·70	17·10	7·70	0·50	17·60	100·60
III.	47·70	24·10	10·00	5·80	12·41	100·01

L. J. S.

[Anorthoclase] from Port Victor, South Australia. H. W. GARTRELL (*Chem. Zentr.*, 1908, ii, 1063; from *Trans. Roy. Soc., South Australia*, 27, 256—260).—The granite of this locality contains large porphyritic crystals of anorthoclase, which are flesh-red and translucent to opaque; D 2·58. The following analysis corresponds with $Or_{23}Ab_8An_4$:

SiO_2.	Al_2O_3.	Fe_2O_3, MnO, MgO.	CaO.	Na_2O.	K_2O.	Loss on ignition.	Total.
64·54	19·34	traces	1·24	2·89	11·84	0·58	100·43

L. J. S.

Cordierite-pinites from Central France. FERDINAND GONNARD (*Bull. Soc. franç. Min.*, 1908, 31, 171—181).—A description is given of the occurrence of the pseudomorphs after cordierite in the departments of Puy-de-Dôme, Loire, and Rhône. The following analysis, by P. Barbier, is given of large, dark green crystals, with a perfect cleavage and D 2·77, which occur with microcline, smoky quartz, and apatite in a pegmatite at Vizézy:

SiO_2.	Al_2O_3.	FeO.	MnO, CaO.	MgO.	K_2O.	Loss on ignition.	Total.
42·43—42·66	33·21—32·95	10·58	traces	2·61	4·75	6·29	99·87

L. J. S.

Contact Minerals (Gehlenite, Spurrite, and Hillebrandite) from Mexico. FRED. E. WRIGHT (*Amer. J. Sci.*, 1908, [iv], 26, 545—554).—These minerals were formed near the junction of altered limestone and intrusive basic diorite in the Velardeña mining district in Durango.

Gehlenite occurs as massive, granular aggregates together with spurrite, yellow garnet, and calcite. It is dark grey in colour, owing to abundant minute inclusions of magnetite, and only rarely are small pieces, free from magnetite inclusions, of an amber-yellow colour; D^{25} 3·039. Analysis I is very similar to previous analyses of gehlenite, but no simple formula can be deduced, the mineral probably representing a solid solution of several end members of a series:

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.
I.	26·33	0·03	27·82	1·43	0·50	0·01	2·44
II.	26·96	0·01	0·39	0·11		0·03	0·23
III.	32·59	0 02	0·23	0·15		0·01	0·04

	CaO.	Na_2O.	K_2O.	H_2O.	CO_2.	Total.
I.	39·55	0·21	0·10	1·85	nil	100·27
II.	62·34	0·05	trace	nil	9·73	99·85
III.	57·76	0·03	0·05	9·36	nil	100·24

Spurrite occurs as granular masses with glistening cleavages, resembling crystalline marble in appearance; no crystals were observed. The mineral is transparent to translucent, and colourless to pale grey with tints of blue or yellow; lustre, vitreous to resinous; hardness, 5; D^{25} 3·014. The optical characters indicate that the symmetry is probably monoclinic; the birefringence is high ($\gamma - \alpha =$ 0·039), the axial angle small ($2E = 70°$), the sign negative, and there is a noticeable crossed dispersion. Lamellar twinning occurs on more than one plane perpendicular to the plane of symmetry, and there are two cleavages, with an angle of 79°, perpendicular to the same plane. Before the blowpipe, the mineral becomes white and porcelain-like, and is infusible. It effervesces in dilute hydrochloric acid, and is readily dissolved with the separation of gelatinous silica. Analysis II corresponds with the formula $2Ca_2SiO_4,CaCO_3$.

Hillebrandite possesses a fibrous structure, the fibres being often aggregated as radial sperulites; it is associated with yellow garnet and wollastonite. The material is white, often with a tinge of green, and porcelain-like, and is translucent only in small chips; hardness, 5½; D^{25} 2·692. The optical characters of the fibres suggest orthorhombic symmetry. Before the blowpipe, the mineral fuses to a colourless glass. It readily dissolves in hydrochloric acid, with the separation of some silica, and is slowly decomposed by water. Analysis III gives the formula $2CaO,SiO_2,H_2O$.

Attempts to prepare the new minerals spurrite and hillebrandite synthetically have so far been unsuccessful. L. J. S.

Mineralogy of the Færoe Islands. MATTHEW F. HEDDLE (*Chem. Zentr.*, 1908, ii, 1061; from *Trans. Geol. Soc. Glasgow*, 1906, 12, 1—15).—Anal. I of bluish-white spheres of faröelite from Nolsö; II, of mesolite occurring on sphærostilbite from Nolsö; III, of stilbite from Bordö.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	42·50	28·06	—	11·35	5·60	—	13·02	100·53
II.	46·80	26·46	—	9·08	5·14		12·28	99·76
III.	58·79	14·613	0·47	9·534	0·324	0·232	17·298	101·261

L. J. S.

Phillipsite from Mont Simiouse, Loire. Ferdinand Gonnard (*Bull. Soc. franç. Min.*, 1908, 31, 269—271).—Analysis by P. Barbier of crystals of phillipsite associated with chabazite and offretite lining cavities in basalt at Mont Simiouse gave:

SiO_2.	Al_2O_3.	CaO.	BaO, MgO.	K_2O.	Na_2O.	H_2O.	Total.
52·10	18·33	4·96	traces	6·88	1·10	16·55	99·92

This agrees with the formula $RAl_2Si_5O_{14},5H_2O$ (where R = Ca, K, Na), whilst some analyses of phillipsite from other localities have given the formulæ $RAl_2Si_4O_{12},5H_2O$, $RAl_2Si_4O_{12},4H_2O$, and $RAl_2Si_3O_{10},3\frac{1}{2}H_2O$. The present mineral therefore represents an acid type of phillipsite, similar to that from Giessen and the Kaiserstuhl. L. J. S.

The Pumice of the Volcano of Mont Dore. Alfred Lacroix (*Compt. rend.*, 1908, 147, 778—782).—A description is given of the fragmentary materials, more particularly the pumice, of this extinct volcano. Rhyolitic pumice (anal. I and II, by F. Pisani) with a fibrous structure occurs only in small pieces; it consists almost entirely of a colourless glass with very few phenocrysts of anorthoclase, surrounded by orthoclase. The composition is identical with that of the rhyolite (anal. III). Trachytic pumice (anal. IV) has a cellular structure and is less glassy, containing phenocrysts of orthoclase, anorthoclase, biotite, and augite, together with microlites of orthoclase.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	TiO_2.	H_2O.	Total.
I.	73·90	10·95	0·08	1·06	1·08	1·58	4·08	4·60	—	3·35	100·68
II.	73·90	11·93	0·15	0·87	0·13	0·34	4·10	4·62	trace	4·00	100·04
III.	75·50	13·50	0·95	—	0·39	0·99	4·35	4·15	trace	0·37	100·20
IV.	60·50	18·20	1·20	1·08	0·26	0·68	5·10	5·23	0·39	7·00	99·64

L. J. S.

Rare Renfrewshire Minerals. Robert S. Houston (*Chem. Zentr.*, 1908, ii, 1062; from *Trans. Geol. Soc. Glasgow*, 1906, 12, 354—361).—Several minerals are described, and analyses given of the following: I, labradorite from Gleniffer Hills, south of Paisley; II, pectolite, massive and fibrous, from South Quarry, Craigenfeoch, near Johnstone; III, stilbite, red, from near Kilbarchan.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	MnO.	K_2O.	Na_2O.	H_2O.	Total.
I.	53·82	28·09	2·88	3·62	4·24	trace	2·25	3·70	2·00	100·60
II.	55·38	trace	—	33·68	trace	—	—	7·20	3·30	99·56
III.	55·02	16·48	trace	7·24	0·58	—	—	4·46	17·00	100·78

L. J. S.

Weathering and Formation of Kaolinite in the Halle Quartz-porphyry. Victor Selle (*Chem. Zentr.*, 1908, ii, 1203; from *Zeits. Naturw.*, 1907, 79, 321—421).—Analysis I is of the white product of weathering, and II, of the portion insoluble in concentrated sulphuric acid; the latter consists of quartz, 3·58%, and felspar, 7·97%. Deducting from the soluble portion the alkalis as sericite, the sulphuric anhydride as gypsum, and neglecting the magnesia, the remainder has the composition $2Al_2O_3,5SiO_2,4H_2O$, whereas kaolinite has the formula $2Al_2O_3,4SiO_2,4H_2O$.

The mineralogical composition of the sample is given as: quartz, 11·56; felspar, 7·97; kaolinite, 71·45; sericite, 4·06; other minerals, 4·96%.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	SO_3.	H_2O.	Alkalis.	Total.
I.	51·05	27·07	5·51	1·01	2·09	1·45	10·30	1·52	100·00
II.	8·83	1·44	0·08	0·12	0·04	—	—	1·04	11·55

The alteration of the felspar in the rock has given rise, first to mica, and this has subsequently been altered to kaolinite. In the Halle district the decomposed porphyries are richer in kaolinite nearer the surface, and minerals of pneumatolytic origin are absent. The conclusion is therefore drawn that the formation of kaolinite is dependent on the ordinary processes of weathering, only these were more intense in their action in former times than at present.

L. J. S.

Analysis of London Clay. John H. B. Jenkins (*Geol. Mag.*, 1908, [v], 5, 265—266).—In a well-boring at East Ham, the stratum of clay extends from 17 to 76 feet below the surface. The wet, stiff clay of dark grey colour loses 20·1% at 120°, and on ignition there is a further loss of 6·3%. The ignited material is brick-red, and contains:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Total.
67·9	18·3	8·7	1·3	1·2	1·6	1·4	100·4

L. J. S.

Red Porphyry [Porfido Rosso Antico]. J. Couyat (*Compt. rend.*, 1908, **147**, 988—990).—The ancient quarries whence this celebrated ornamental stone was obtained by the Romans are situated along the Wadi Abu Maammel, on the north-west slopes of the Jebel Dokhan, in Egypt. The crystalline schists of the district are penetrated by necks of hornblende-andesite and by veins of various other igneous rocks (this vol., ii, 65). This andesite, when unaltered (anal. II), is greenish-black or ebony-black, and contains phenocrysts and microlites of andesine and hornblende together with much apatite and magnetite. The hornblende (anal. I) contains some manganese; it has a maximum extinction angle of 22°, and its pleochroic colours are pale yellow to green. The red porphyry (anal. III) is found in the central, more crystalline portions of the necks, and it is an altered form of the hornblende-andesite; there is a gradual passage from one rock to the other, a violet porphyry forming an intermediate zone. The simultaneous decomposition of the hornblende and felspar has given rise to much manganiferous epidote (withamite), but the red colour of the rock is mainly due to the large quantity of finely-divided hæmatite; other secondary minerals are damourite, actinolite, and biotite.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	MnO.	Na_2O.	K_2O.	H_2O.	Total.
I.	44·5	1·5	12·5	12·2	4·0	9·5	11·1	0·4	3·9		0·5	100·1
II.	64·3	0·45	16·4	1·85	2·5	4·7	3·0	trace	4·3	2·0	0·6	100·1
III.	64·4	0·65	16·1	3·5	1·0	5·0	2·7	trace	4·2	1·6	1·1	100·25

L. J. S.

[Hypersthene-Augite from Lake Onega.] WALTER WAHL (*Fennia, Helsingfors*, 1908, **24**, No. 3, 1—94).—In a paper on the geology of the west coast of Lake Onega, Russia, are given several rock analyses, together with the following analysis of a pyroxene isolated from a coarse-grained quartz-diabase from Schtscheliki.

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	NiO.	MnO.	MgO.
50·36	0·80	2·49	2·35	18·15	0·04	0·56	11·37

CaO.	Na_2O.	K_2O.	H_2O.	Total.	Sp. gr.
13·97	0·26	0·19	0·55	101·09	3·46

The crystals show a zonal structure with varying optical characters; in the inner portion, $2E = 48°42'$, and in the outer, $2E = 73°8'$; $c : \mathfrak{c} = 45°$. The mineral belongs to the group of enstatite-augites, and is a hypersthene-augite.

L. J. S.

Gabbro and Iron-ore of the Jubrechkine Kamen, Northern Urals. LOUIS DUPARC (*Compt. rend.*, 1908, **147**, 1061—1063).—This mountain is formed entirely of uralitised gabbro (anal. I) of various types, and irregularly distributed through the rock are basic segregation patches (anal. II), often of considerable size. These patches consist largely of magnetite, together with hornblende and a little epidote and kaolin.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.
I.	47·97	1·30	13·50	3·55	11·47	trace	10·63	6·51	0·26	2·78	1·60	99·57
II.	26·62	9·50	11·62	19·50	21·87	0·20	6·47	2·57	0·34	1·06	1·30	101·05

L. J. S.

Mode of Formation of the Puy de Dôme. ALFRED LACROIX (*Compt. rend.*, 1908, **147**, 826—831).—The structure of this extinct volcano is compared with the recent West Indian volcanoes, and found to resemble that of Guadeloupe rather than Mt. Pelée. Analyses are given of domites with biotite or with hornblende, and of the fragmentary derivatives of these rocks. L. J. S.

Eruptive Rocks of Jebel Dokhan, Red Sea. J. COUYAT (*Compt. rend.*, 1908, **147**, 867—869).—Veins and bosses of the eruptive rocks penetrate the conglomerates and schistose sediments which rest on a granitic massif. Analyses are given of granite, microgranite, micropegmatite, rhyolite, andesite, and labradorite.

L. J. S.

Possible Existence of a Nickel-Iron (Fe_5Ni_3) in Meteorites. LAZARUS FLETCHER (*Min. Mag.*, 1908, **15**, 147—152).—In the analysis of the meteoric stone of Zomba (Abstr., 1901, ii, 400), the repeated extractions of the nickel-iron with mercuric ammonium chloride showed that the residue became gradually richer in nickel. This was at the time attributed to the rusting of the iron in the minute particles of the alloy, but is now explained by the presence of a nickel-iron constituent, Fe_5Ni_3, containing 38·50% Ni(Co), which is not readily attacked by the mercuric solution. This constituent is identical with the "taenite", containing 38·13% Ni(Co) isolated, by reason of its insolubility in dilute hydrochloric acid, from the Youndegin iron (Abstr., 1900, ii, 27). From an examination of the thermo-magnetic characters of the Sacramento iron, S. W. J. Smith (*Phil. Trans.*, 1908, *A*, 208, 21) has recently concluded that this meteorite contains a nickel-iron with not less than 37% Ni, thus confirming the above results. L. J. S.

Investigations on the Gases of the Wiesbaden Thermal Springs. Ferdinand Henrich (*Ber.*, 1908, 41, 4196—4209. Compare Abstr., 1905, ii, 6, 221; 1907, ii, 150).—The gases evolved by some of the thermal springs at Wiesbaden have been analysed, and found to contain carbon dioxide, nitrogen, oxygen, methane, hydrogen sulphide, argon, neon, helium, and radium emanation in the following proportions, the values given being volume percentages. *Kochbrunnen* ($t = 68{\cdot}7^{\circ}$): gas absorbed by potassium hydroxide 84·8, oxygen 0·2, nitrogen 12·7, methane 0·6, rare gases (argon, etc.) and emanation 1·7; *Adlerquelle* ($t = 64{\cdot}6^{\circ}$): gas absorbed by potassium hydroxide 77·6, oxygen 1·2, nitrogen 18·4, methane 0·8, rare gases and emanation 2·0; *Schützenhofquelle* ($t = 49{\cdot}2^{\circ}$): gas absorbed by potassium hydroxide 32·4, oxygen 0·2, nitrogen 62·05, methane 0·45, rare gases and emanation 4·9. The composition of the evolved gas varies slightly and irregularly throughout the year.

It is probable that the gases are derived from the rocks in the vicinity of the springs, since it has been found that these rocks when heated alone or with potassium hydrogen sulphate evolve oxygen, nitrogen, helium, and argon. The oxygen is absorbed by the ferrous carbonate present in the spring-water. W. H. G.

Physiological Chemistry.

Effects of Low Pressures on Respiration. Arthur Boycott and John S. Haldane (*J. Physiol.*, 1908, 37, 355—377). **Alveolar Air on Monte Rosa.** R. Ogier Ward (*ibid.*, 378—389). **Effects of Want of Oxygen on Respiration.** John S. Haldane and Edward P. Poulton (*ibid.*, 390—407).—The experiments on the effect of low atmospheric pressure on respiration were carried out on men, partly on Monte Rosa and partly in a specially-constructed steel chamber. When the pressure is diminished, the alveolar carbon dioxide pressure remains constant during short exposures. When the air pressure reaches 550 mm., or the alveolar oxygen pressure 62 mm., the alveolar carbon dioxide pressure falls, and as the air pressures fall, the fall in the carbon dioxide pressure occurs with increasing rapidity. In long exposures, the fall in the carbon dioxide pressure occurs earlier and further; the alveolar oxygen pressure is correspondingly higher; the process is one of gradual adaptation to low pressures or great altitudes. The fall in alveolar carbon dioxide pressure is due to hyperpnœa dependent on the low oxygen pressure, and is absent if oxygen is added to the air. The hyperpnœa is, however, not directly due to want of oxygen, since it takes time to develop, and may persist for days after the want of oxygen is removed. It is probably due to the gradual formation, in consequence of insufficient oxygen, of lactic acid or other substances which have the same influence as carbon dioxide on the respiratory centre, so that less carbon dioxide is required to excite the centre. When the alveolar oxygen pressure falls to 30 mm., urgent symptoms are produced. Exposure to cold causes a slight rise, and to heat, a slight fall in the alveolar carbon dioxide pressure.

If sufficient of the preformed carbon dioxide is first removed by forced breathing, want of oxygen has no exciting influence on the centre, and apnœa will be produced, and does not cease until the alveolar carbon dioxide pressure rises to normal, unless abnormal products produced by want of oxygen reinforce the action of the carbon dioxide; the development of these other products is, however, a gradual process. W. D. H.

Experiments on the Gaseous Metabolism of Infants carried out by means of Zuntz and Oppenheimer's Modification of the Regnault-Reiset Respiration Apparatus. ARTHUR SCHLOSSMANN, CARL OPPENHEIMER, and HANS MURSCHHAUSER (*Biochem. Zeitsch.*, 1908, 14, 385—406).—The experiments were carried out by means of the apparatus described by two of the authors (*ibid.*, 361—368, 369—384). In the case of a healthy child (4½—5 months old) sleeping for eight hours after feeding, the oxygen utilised was 0·731 gram, and the carbon dioxide excreted, 0·931 gram per kilo. per hour. The respiratory quotient was 0·911. These numbers were greater for the first three hours after the meal than for the later period. In similar experiments, when the child was awake for a part of the experimental period, the oxygen consumed was 0·853 gram, and the carbon dioxide excreted 1·046 grams per kilo. per hour, the respiratory quotient being 0·896. Experiments were also carried out on children during a period of fast in pathological cases, and results differing markedly from the above were obtained. S. B. S.

Effect of Salt Solutions on the Heart and Respiration of the Skate. IDA H. HYDE (*Amer. J. Physiol.*, 1908, 23, 201—213).—As a rule, increase of heart-beat produced by various salts is accompanied by rise of blood-pressure and increase of respiratory activity. Ammonium chloride, however, increases blood-pressure without increasing cardiac force; disodium hydrogen phosphate increases the force of the heart, but not that of respiration, and urea increases cardiac and respiratory activity without raising the blood-pressure. The salts which are specially depressing are potassium chloride and magnesium sulphate. Many other details are added in relation to concentration, etc., of these and other salts. W. D. H.

Coagulation-time of Blood in Man. T. Addis (*Quart. J. exp. Physiol.*, 1908, 1, 305—334).—Daily variations in the coagulation-time of the blood do not occur; the administration of citric acid or of calcium salts also makes no difference. The contrary result is due to errors in technique, the influence of temperature having been disregarded in all previous measurements of coagulation-time. The coagulation-time is shortest between 36° and 40°; at temperatures above and below this, it increases. A new method is described in which temperature and other factors are kept constant; the observation is made with a microscope, and depends on the fact that when a current of oil streams along the side of a drop of blood, a smooth flow of the corpuscles is induced. The movement stops suddenly when coagulation takes place.
W. D. H.

Blood-Clot of the King-crab. Carl L. Alsberg and E. D. Clark (*J. Biol. Chem.*, 1908, 5, 323—330).—The blood-clot is considered to consist of the agglutinated cells of the blood only, without admixture with any substance akin to fibrin. The solubilities and the low sulphur and tyrosine contents are thought to point to the protein present as being a member of the gelatin-elastin group. W. D. H.

The Sugar in Blood. IV. The Method of Osmotic Compensation. Leonor Michaelis and Peter Rona (*Biochem. Zeitsch.*, 1908, 14, 476—483).—Experiments were carried out with the object of determining whether the sugar in blood exists free or combined in some form as a colloidal complex. For this purpose, the total sugar was estimated polarimetrically after precipitating the proteins by colloidal ferric hydroxide. Portions of the blood were then dialysed against an isotonic salt solution (containing a small quantity of sodium fluoride) to which varying amounts of sugar had been added. After twenty-four hours, the sugar was estimated in the dialysate. An increase in the latter, after the dialysis, would denote that the original liquid contained less sugar than the blood, whereas a diminution would indicate that it contained more. It was found that the amount of sugar in the dialysate did not alter after dialysis, when it contained the same percentage of sugar as was found in the blood by the method described above; hence the sugar in the blood exists in a free state.
S. B. S.

The Total Sugar of the Blood. Raphael Lépine and Boulud (*Compt. rend.*, 1908, 147, 1028—1031. Compare Abstr., 1908, ii, 957).—The amount of sugar obtained from the blood-clot depends to a somewhat considerable extent on the duration of the hydrolysis by hydrofluoric acid, for, besides liberating the sugar, the acid also slowly destroys it. The sugar obtainable from the clot is in any case a considerable portion of the total sugar of the blood. G. B.

Diastases in the Blood and Body Fluids. Anton J. Carlson and A. B. Luckhardt (*Amer. J. Physiol.*, 1908, 23, 148—164).—The diastases in blood and lymph are mere "discards" of the tissues on the road to destruction or elimination, and serve no essential end in the body processes. Their amount is not related to pancreatic activity, to changes in the diet, or to the rate of oxidation in the body. Such differences as are noticeable in different fluids, or in the same fluid at different times, appear to be of an accidental nature.

W. D. H.

The Maltase of the Blood-serum and Liver. CHOSABURŌ KUSUMOTO (*Biochem. Zeitsch.*, 1908, 14, 217—233).—This is a comparative study of the action of the maltase of the blood and liver extract in different animals. The absolute and relative strength of the action varies considerably, being greatest in the pig and least in the sheep, of the animals examined, so far as relates to the maltase of the blood, but the liver extract is more powerful in the sheep than in the pig or dog. In the calf and horse, the two ferments act about equally. This varying action may depend on the amount of ferment present, or on the presence of such inhibitory substances as anti-maltase.

W. D. H.

The Occurrence of Proteic Acids in Blood. JÓZEF BROWIŃSKI (*Zeitsch. physiol. Chem.*, 1908, 58, 134—146. Compare Abstr., 1908, ii, 205).—The proteic acids described by Bondzynski in the urine of men and dogs are also present in blood; one litre of horse's serum contains 0·137 gram of oxyproteic acid. W. D. H.

Cytolysis. ALONZO E. TAYLOR (*J. Biol. Chem.*, 1908, 5, 311—314).—Injections of salmon sperm into rabbits renders the blood capable of causing cytolysis of the spermatozoa. The serum was inactive if the spermatozoa used were stale, so also was the sera from animals inoculated with the lipoidal, protamine, or nucleic acid fractions obtained from the cells. W. D. H.

Precipitin Reactions. W. A. SCHMIDT (*Biochem. Zeitsch.*, 1908, 14, 294—348).—If dried serum is heated at 110°, it does not lose its power of reacting to precipitin; if heated at 130°, this property is lessened, and at 150° almost entirely lost. If the serum is not dried, heating at 70° for an hour does not destroy the property, and the reaction may be obtained even after heating at 90°. These temperatures are higher than those given by previous observers. Passing from the precipitable substance to the precipitin, this is not so thermostable; still heating at 75° for several hours does not entirely destroy it, and precipitin serum, after heating at 70°, is still capable of producing immunisation. If heated with alkali, similar results are obtained. Various theoretical deductions from these experiments are discussed. W. D. H.

Sensibilising Action of Animal Pigments. I. WALTHER HAUSMANN (*Biochem. Zeitsch.*, 1908, 14, 275—278).—Vegetable extracts which contain chlorophyll act hæmolytically on red corpuscles in the light, but not in the dark. This is not a property confined to chlorophyll, but is also possessed by certain animal pigments, and in the present paper, bile pigment is shown to possess it. This may play a part in diseases where pigmentary changes occur in parts exposed to light, such as the skin. Hæmatoporphyrin acts in the same way both on red corpuscles and on other animal cells, such as paramœcium.

W. D. H.

The Influence of Neutral Salts on Hæmolysis. RUDOLF HÖBER (*Biochem. Zeitsch.*, 1908, **14**, 209—216).—The action of weak hypotonic solutions of neutral salts of the alkalis is to cause discharge of the hæmoglobin from the red corpuscles of the ox. The anions favour hæmolysis in the following order: $SO_4 < Cl < Br, NO_3 < I$, and the cations in the following: $Li, Na < Cs, Rb < K$. The action probably depends on an action on the membrane increasing its permeability. W. D. H.

The Hæmolysin of Human Pancreatic Juice. II. JULIUS WOHLGEMUTH (*Chem. Zentr.*, 1908, ii, 1111; from *Berl. Klin. Woch.*, 1908, **45**, 1304—1305).—Inactive pancreatic juice, in spite of its lipolytic properties, does not contain hæmolysin. On activating with enterokinase or calcium chloride, or by keeping, it acquires the property of dissolving red blood-corpuscles under certain conditions. The addition of lecithin also causes the juice to acquire hæmolytic properties, although it is not thereby activated as regards trypsin. The hæmolytic properties are possibly due to the setting free by the activated trypsin of lecithin from some protein lecithide complex.

S. B. S.

Effect of Diet on Saliva. CHARLES HUGH NEILSON and M. H. SCHEELE (*J. Biol. Chem.*, 1908, **5**, 331—338).—Saliva hydrolyses starch to maltose and maltose to dextrose, and so probably contains two enzymes. A carbohydrate diet increases both actions, and a protein diet lessens both in the same proportion. These facts are considered to prove adaptation to diet. The experiments were conducted on men. W. D. H.

Assimilation of Formaldehyde and of Glycerol and Sugar. THOMAS BOKORNY (*Pflüger's Archiv*, 1908, **125**, 467—491).—If, as is believed, carbon dioxide is changed into formaldehyde by the action of chlorophyll granules, the condensation of the latter substance must occur with great rapidity, for, except in minimal amount, it is very toxic to life, and to the chlorophyll apparatus. On treatment with dilute formaldehyde, starch formation is increased, and this occurs in the dark and under the influence of light with equal rapidity. The energy of light is necessary in the formation of formaldehyde from carbon dioxide. Oxygen is not essential either for the assimilation of formaldehyde, glycerol, or sugar.

W. D. H.

Metabolism of Glycine in Liver Affections. HERMANN JASTROWITZ (*Arch. exp. Path. Pharm.*, 1908, **59**, 463—472).—In normal persons, the administration of 20 grams of glycine does not lead to its appearance in the urine, but in those with liver disease

and in dogs suffering from phosphorus poisoning, if glycine is given, a good deal escapes conversion into urea and passes into the urine.
W. D. H.

Liebig's Extract of Meat. R. ENGELAND (*Zeitsch. Nahr. Genussm.*, 1908, 16, 658—664).—The following bases were separated and identified in Liebig's extract of meat, the method employed being a modification, in part, of that described by Kutscher and Steudel: creatinine, neosine, carnitine (Abstr., 1905, i, 726), vitiatine (Abstr., 1907, ii, 708), histidine, methylguanidine, and alanine. W. P. S.

The Assimilation of Carnitine in the Animal Body. R. ENGELAND (*Zeitsch. Nahr. Genussm.*, 1908, 16, 664—666).—It is shown that carnitine when administered to dogs is entirely decomposed, and is probably converted into dimethylguanidine, as this base was detected in the urine. In the case of rabbits, it appears that carnitine is reduced during its passage through the body, but the small quantity of base recovered from the urine did not allow of its identity being established with certainty. W. P. S.

Hydrolytic Enzymes of Invertebrates. HERBERT E. ROAF (*Bio-Chem. J.*, 1908, 3, 462—472).—Glycerol extracts of the digestive glands of various invertebrates (arthropods, molluscs, echinoderms) were employed, or in some cases, the alcohol precipitate from such extracts. Enzymes capable of hydrolysing starch and glycogen, fats, and proteins were found. The addition of these extracts to milk and oxalated blood-plasma caused coagulation. Variations as to the presence and activity of all these ferments occur, and many results are stated quantitatively. In relation to the proteoclastic enzymes, the Congo-red fibrin method of the author was mainly employed; variations are noted in the reaction of the medium which gives the best results. W. D. H.

Is Choline Present in the Cerebro-spinal Fluid of Epileptics? S. KAJIURA (*Quart. J. exp. Physiol.*, 1908, 1, 291—296).—Relying on Rosenheim's periodide test, which is both trustworthy and sensitive, choline was not found in the cerebro-spinal fluid in cases of epilepsy. The detection of a few fragments of anisotropic crystals by Donath's micro-polariscopic test is not in itself sufficient evidence of the presence of choline; treated in the same way with platinic chloride, etc., the same result may be obtained with normal cerebro-spinal fluid, or even with distilled water.
W. D. H.

Chemico-physical Investigations on the Crystalline Lens. III. Imbibition of the Crystalline Lens in Water and in Water Vapour. FILIPPO BOTTAZZI and NOÈ SCALINCI (*Atti R. Accad Lincei*, 1908, [v], 17, ii, 445—454. Compare Abstr., 1908, ii, 966, 1054).—The penetration of water into the crystalline lens, and the swelling and increase in weight of the latter, is due to some extent to a process of imbibition, and not, as is usually supposed, solely to the osmotic pressure of the lens. As there is not an imbibition equilibrium between the lens and the water in which it is immersed, the water penetrates the lens, at first rapidly and subsequently more slowly. The lens tends towards a maximum of imbibition, which is, however, only attained if the capsule is ruptured. In this imbibition, there are two distinct periods, in the first of which water penetrates the lens and causes it to swell uniformly, whilst in the second the water accumulates between the lens and the capsule. Experiment shows that the percentage increase of weight of a lens from which the capsule has been removed is less than in the case of a lens which retains its capsule. When no capsule is present, the lens increases rapidly in weight during about the first half-hour of immersion, after which the increase is first checked for a time and then proceeds more gradually; this is due to the diffusion from the lens of the soluble facoprotein, the loss thus caused being sufficient to compensate, for a time, the increase in weight due to imbibition.

When suspended in saturated water vapour at 38°, the crystalline lens does not increase, but gradually diminishes, in weight, a process of disimbibition taking place. From this point of view, the crystalline lens may be regarded as a block of solid hydrogel, since swollen gelatin behaves in the same way when suspended in water vapour (compare Schroeder, Abstr., 1903, ii, 721). The amount of disimbibition of the lens in water vapour is, for a definite time, directly proportional to the initial weight of the lens, whilst the increase in weight of a lens due to imbibition in water is inversely proportional to that weight. The mechanism of the process of disimbibition is essentially different from that of the process of imbibition.

T. H. P.

Effect of Stimulation of the Accelerator Nerve on the Saline Metabolism of the Isolated Heart. William H. Howell and W. W. Duke (*Amer. J. Physiol.*, 1908, 23, 174—179).—A comparatively small supply of Locke's fluid was continuously perfused through isolated cats' hearts by the method described by Locke and Rosenheim. Neither the calcium nor the potassium in the fluid showed any variation in amount after a perfusion lasting for hours, and after long-continued excitation of the cardiac accelerator nerve. No trace of hypoxanthine was discovered in the fluid, although Burian describes this substance as being continuously formed in skeletal muscle, and increased in amount during its contraction. The difference may be due to an essential difference between the two kinds of muscle, or to the presence of dextrose in Locke's fluid. The heart, however, gives off creatinine (or creatine) to the circulating fluid.

W. D. H.

Action of Barium Chloride on the Normal Heart, and the Heart which has Undergone Fatty Degeneration. Renato de Nicola (*Chem. Zentr.*, 1908, ii, 961; from *Arch. Farm. sperim.*, 1908, 7, 130—138).—Barium chloride is a myocardial poison with marked action on the muscle, but influences little, or not at all, the heart movements of an organ which has undergone fatty degeneration, and only causes death by exhaustion.

S. B. S.

The Sugar Utilised in the Isolated Heart. MARIO CAMIS (*Chem. Zentr.*, 1908, ii, 1194; from *Zeitsch. allg. Physiol.*, 1908, 8, 371—404).—The relationship between the amount of work done by an isolated heart and the amount of sugar utilised from a Ringer-Locke solution was investigated. The apex of the heart (from rabbits, cats, and a fox), which was perfused in a Langendorff apparatus, was weighted by different loads, and from the number and size of the contractions, the amount of work performed was calculated. It was found in the case of the rabbit that, for the same amount of mechanical work, the larger was the amount of sugar utilised the greater the load attached to the heart. A direct proportionality between the sugar utilised and the work of the heart could not, however, be ascertained. The hearts of cats and of foxes utilised no sugar under the same conditions of experiment. In these cases, glycogen seems to disappear, the fresh hearts of cats and foxes containing more of this carbohydrate than was found in those organs which had been employed in the perfusion apparatus. A similar difference was not found in the case of rabbits. The conclusion was drawn that in herbivora the source of muscular energy is the sugar which is obtained directly from the food-stuffs, or by degradation of other carbohydrates, whereas, in the case of carnivora, the source is the glycogen of the muscles, which has been prepared from the proteins of the food-stuffs. S. B. S.

Fate of Glycerol in the Body. FELIX REACH (*Biochem. Zeitsch.*, 1908, 14, 279—285).—The liver was perfused with Ringer's solution by a method similar to that used by Locke and Rosenheim in their investigations on the utilisation of sugar by the beating heart. It is shown that the liver has the power of synthetically forming acetoacetic acid in small quantities from glycerol. This is not in contradiction to the antiketogenic action of glycerol. W. D. H.

Liver Cells and their Permeability to Sugar. P. C. ROMKES (*Biochem. Zeitsch.*, 1908, 14, 254—274).—The author claims to have proved by four distinct methods that the walls of liver cells are permeable to dextrose. The wall of the nucleus, on the other hand, appears to be impermeable to dextrose. These facts have an important bearing on the reversible hydrolysis of glycogen to dextrose; $C_6H_{10}O_5 + H_2O \rightleftharpoons C_6H_{12}O_6$. J. J. S.

Conversion of Glycogen into Sugar by the Liver. ALONZO E. TAYLOR (*J. Biol. Chem.*, 1908, 5, 315—318).—Flask experiments on the liver of the giant clam show a post-mortem conversion of its glycogen into sugar, which is believed to be analogous to what occurs during the life of the animal. The conversion is a function of two variables and is proportional directly to them, namely, the masses of glycogen and of glycolytic ferment in the liver cells. W. D. H.

The Animal Fats and the Extract by Light Petroleum from the Liver. YUTAKA NUKADA (*Biochem. Zeitsch.*, 1908, 14, 419—429). —The content of animal fats in lower fatty acids was estimated by hydrolysing the fats, adding to the soaps just sufficient acid to neutralise the alkali used, and washing the separated fatty acids with water until the washings were no longer acid ("filtration method"). The volatile acids in the washings were also estimated by distillation. The acetylation number was determined by similar processes. The acetylation numbers of the fats, fatty acids, and light petroleum extracts were determined. It was found that the fatty acids in the fats from adipose tissues, which are soluble in water and volatile with steam, amount to 0·4 to 0·7% of the total. These fats contain, when fresh, only small quantities of substances with a free hydroxyl group; with the age of the fat, however, the number of these groups increases. On hydrolysis of the fats, substances containing free hydroxyl groups are obtained, amongst which are cholesterol and appreciable quantities of hydroxy-acids. Liver extracts contain cholesterol, but not cholesterol esters; hydroxy-acids also seem to be present. S. B. S.

The Influence of Radium Emanations on Autolysis. Simon Löwenthal and E. Edelstein (*Biochem. Zeitsch.*, 1908, 14, 484—490).—Radium emanations appreciably increase the rate of autolysis of tissues, especially in the expressed juices from certain carcinomatous growths. S. B. S.

The Influence of Inorganic Colloids on Autolysis. V. M. Ascoli and G. Izar (*Biochem. Zeitsch.*, 1908, 14, 491—503).—In the experiments, colloidal silver, prepared by Bredig's method, was employed. It was used in two forms, "stabilised" by the addition of gelatin, and "non-stabilised." Both forms increase the rate of autolysis of liver tissue, whereas the former alone, when in very small doses, causes a rise of temperature when administered to animals. Both forms, however, when given in sufficient doses, cause this rise of temperature, the "stabilised" to a greater extent than the "non-stabilised." The addition of defibrinated blood inhibits the effect of the non-stabilised blood on liver autolysis, but not that of the stabilised; serum, on the other hand, exerts the same effect on both forms of colloidal silver. The addition of sodium chloride inhibits the action of the non-stabilised colloid, but not that of the stabilised. S. B. S.

The Preparation and Chemical Properties of the Xanthoma Substance, with some Investigations of the Fat-like, Doubly-refracting Substance in Large, White Kidneys. J. Pringsheim (*Biochem. Zeitsch.*, 1908, 15, 52—75).—The material for investigation of the xanthoma was obtained from the dura mater and the skin of a woman who suffered from chronic icterus with hypertrophic cirrhosis of the liver. The material was extracted with alcohol and then with acetone, and from the latter solvent, crystals separated which, after repeated recrystallisations from the same solvent, melted at 67·5°. The dura mater material contained 14·2% of this substance. It was free from phosphorus and nitrogen, and yielded, on hydrolysis with sodium ethoxide in benzene solution, a residue which, on recrystallisation from alcohol, melted at 144·5° and gave the characteristic cholesterol reactions. The fatty acids obtained by hydrolysis were not identified; the lead salts were partly soluble in ether. There is evidence, therefore, that the doubly-refracting substance is an ester of cholesterol. Similar substances, melting at 54° and 52°, were obtained from the kidneys of a woman who had died from tuberculosis of the lungs, and of a child who had died from uræmia. In these cases, there was not sufficient evidence to determine whether the doubly-refracting substance consisted entirely of cholesterol esters, as the yield obtained was small. The author calls attention to the pathological significance of the facts, and the need for chemical identification of the doubly-refracting substances. S. B. S.

Spontaneous Movements of Amphibian Muscle in Saline Solutions. George Ralph Mines (*J. Physiol.*, 1908, 37, 408—444).—The rhythmical periods in the contractions produced by exposing amphibian muscles to a 0·7% solution of sodium chloride vary from 6 to 0·06 sec., and the movements continue in the presence of curare; large doses of curare abolish them, owing to the inorganic salts in the curare employed. The appearance of movements is accompanied by increased excitability to galvanic currents. The addition of calcium chloride lessens the movements and the excitability. Potassium chloride first increases and then stops both phenomena. The movements are regarded as myogenic. W. D. H.

Comparative Effect of Alcohol, Ether, and Chloroform on Striped Muscle. Effects of Muscarine and Atropine on Striped Muscle. Augustus D. Waller (*Proc. physiol. Soc.*, 1908, lxxi—lxxiv, lxxxi—lxxxiv; *J. Physiol.*, 37).—The comparative anæsthetic effect on the frog's sartorius was tested by the contractions obtained by stimulation when subjected to immersion in various strengths of alcohol, ether, and chloroform respectively in 0·6% sodium chloride solution. The strengths, N/alcohol, $N/10$ ether, and $N/100$ chloroform, are very nearly physiologically equivalent.

The action of muscarine and atropine was tested in a similar way. Both alkaloids act as paralysants, the former more powerfully. The chief difference is that muscarine produces a temporary contracture not unlike that caused by nicotine and caffeine. The muscle recovers when placed in normal saline solution, but this is less complete after atropine than after muscarine. The antagonism of the two drugs is best shown by mixing them together, when the contracture is not observed. W. D. H.

Action of Sodium Cyanide on Muscles and Nerves of Cold-blooded Animals. S. Dontas (*Arch. exp. Path. Pharm.*, 1908, 59, 430—443).—In frogs, sodium cyanide acts not only on the central nervous system, but also on peripheral nerves. Muscles will not contract on stimulation of their nerves when these are exposed to the action of a 0·005% solution of the salt. This is a reversible action, and can be removed by washing with Ringer's solution. In the early stages of poisoning in the intact animal, the toxic effects are removable by the injection of sodium thiosulphate. W. D. H.

Chemical Investigations of Placenta. S. Higuchi (*Biochem. Zeitsch.*, 1908, 15, 95—104).—The mean percentage result of the analysis of six placenta: water, 84·91; dry substance, 15·09; fat, 0·846; unsaponifiable substance, 0·283; glycogen, 0·032; total S., 0·120; total P., 0·140; lecithin, 0·899; total N., 2·266; albumin, 14·16; aqueous extract, 3·974 (containing N., 10·38%; ash, 0·387%); alcoholic extract, 2·070 (containing N., 3·521%; ash, 0·492%); total ash, 0·878. S. B. S.

The Effect of Hydrochloric Acid on the Composition of the Subcutaneous Connective Tissue of Rabbits. J. Ph. Staal (*Zeitsch. physiol. Chem.*, 1908, 58, 97—117. Compare Loghem, Abstr., 1904, ii, 751).—The following determinations have been made with the extract from the subcutaneous connective tissue of normal rabbits and of rabbits to which hydrochloric acid was administered: freezing point, electrical conductivity, and percentage of sodium and of chlorine. It is shown that the percentage of sodium increases rapidly (some 4 to 15 times) after the administration of 0·5% hydrochloric acid during two to seven days. The ratio Na/Cl also increases, and thus Loghem's view, that by the administration of hydrochloric acid alkali is removed from the tissue, is not correct.

Similar experiments were made on the blood of rabbits. These new facts can only be brought into harmony with Loghem's experimental data by concluding that, although the percentage of sodium increases, the sodium concentration decreases in the case of rabbits to which hydrochloric acid has been given. J. J. S.

Arsenic in the Animal Organism. W. H. Bloemendal (*Arch. Pharm.*, 1908, 246, 599—616).—The occurrence and distribution of arsenic in the animal organism, both before and after the administration of arsenical preparations, have been investigated. Full details are given in the original as to the methods used in preparing arsenic-free reagents. The method adopted of destroying the organic matter was that of Fresenius and von Babo, involving the use of hydrochloric acid and potassium chlorate. For the detection of the arsenic, an electrolytic form of Marsh's apparatus was employed, capable of revealing the presence of 0·0001 mg. of arsenic. The formation of an arsenic mirror was depended on for the detection of the poison, and in quantitative work the mirrors formed were dissolved in a sulphuric acid solution of potassium dichromate of known strength and titrated back with *N*/1000 or *N*/4000 sodium thiosulphate.

After administration of arsenic, the latter can be detected in all parts of the organism, but the various parts can be arranged in the following descending order as regards their arsenic content: nails, hair, spleen, thyroid gland, skin, lungs, liver, kidneys, heart, sacrum, muscle, generative organs, and brain (compare Scolosuboff, this Journ., 1876, i, 92; Gautier, Abstr., 1900, ii, 152, 168, 226; 1902 ii, 517; Besredka, 1900, ii, 156; Denigès, 1905, ii, 745). Arsenic commonly occurs in the hair, even when absent from all other parts. Normally, urine contains no arsenic, or only traces. Soon after administration it can be detected in the urine, and disappears again in ten to twelve days after administration ceases (compare Carlson, Abstr., 1907, ii, 130). In man a greater percentage of the arsenic is eliminated in the hair than is the case with rabbits, goats, or cows. Cacodylic acid is converted in the organism into arsenious oxide, but it is not certain that this is the case with atoxyl. The arsenic in sodium cacodylate is eliminated partly in a gaseous form, but this does not appear to be the case with arsenious oxide. No arsenic, or only traces, appears in the milk in the case of the cow, goat, cat, or rabbit, but a small amount appears in human milk. Both in man and animals, only traces of arsenic are found under normal conditions (compare Gautier, *loc. cit.*), and this appears to have no physiological significance and to be absorbed merely in the form of impurities in food, etc. No arsenic is passed from the parent to the fœtus.

T. A. H.

The Relationships of Cyclones to the Animal Organism. EMIL STARKENSTEIN (*Zeitsch. physiol. Chem.*, 1908, 58, 162—164).—Rosenberger's conclusion, that inosite is present in tissues partly as a mother substance (inositogen), is dissented from. The conclusion drawn from quantitative experiments is that the animal organism contains free inosite.

W. D. H.

Oxidation of Products of Cholesterol in the Animal Organism. III. ISAAC LIFSCHÜTZ (*Zeitsch. physiol. Chem.*, 1908, 58, 175—184. Compare Abstr., 1907, ii, 899).—This paper deals with the methods for the detection of oxycholesterol, and further proofs are given that this substance and its precursor exist preformed in blood and bone-marrow. The first oxidation product passes easily into the second.

W. D. H.

The Origin of Glycine from Uric Acid. L. HIRSCHSTEIN (*Arch. exp. Path. Pharm.*, 1908, 59, 401—406).—Further proofs are advanced that glycine originates from uric acid both in the body and *in vitro.* It does not, however, appear to be an end-product of uric acid breakdown, for in alkaline solutions it is destroyed, in part, as soon as it is formed, and if the concentration of the alkali is sufficient, it is difficult to detect any at all.

W. D. H.

Storage and Retention of Quinine in the Human Organism. G. GIEMSA (*Chem. Zentr.*, 1908, ii, 1053; from *Arch. Schiffs-Tropen-hyg.*, 1908, 12, 78—81).—The observation of Schaumann, that quinine can be found in the organs of a dog even when the urine is free from alkaloid, applies also to the case of man. The quantities found were, however, as a rule, so small that they could not be estimated quantitatively. In a kidney weighing 420 grams, 6 mg. were found. The blood was free from quinine, and this observation does not confirm the general opinion that the alkaloid circulates in the blood-stream. The hæmolysis of black-water fever probably occurs in the kidneys.

S. B. S.

The Extractives from Fish Flesh. A. SUWA (*Chem. Zentr.*, 1908, ii, 1112; from *Zentr. Physiol.*, 1908, 22, 307—310).—The extract from the flesh of cod was treated with tannin, barium hydroxide, and lead salts. From the concentrated purified extract, creatinine separated. From the filtrate, the bases were separated by phosphotungstic acid. From the carbonates, the alloxuric bases were precipitated with 20% silver nitrate. Other bases were obtained by fractional precipitation with silver nitrate and barium hydroxide. Creatinine and methylguanidine were obtained in these fractions. After separating excess of silver, other bases were obtained by fractional precipitation of solutions of chlorides with mercuric chloride. S. B. S.

Osmotic Concentration in Body-Fluids of Aquatic Animals. William J. Dakin (*Bio-Chem. J.*, 1908, 3, 473—490).—Further experiments are recorded on fishes and invertebrates which show that changes in the water in which they live brings about sooner or later an alteration in the electrolytes and non-electrolytes of the body-fluids, followed by an alteration in the chemical constitution of their cells. Whether the interchange occurs by the gills or the alimentary canal is left undecided. W. D. H.

Characteristic Principles of Sclerostomum equinum. Presence in this Parasite of an Intensely Hæmolytic Crystalline Alkaloid. Th. Bondouy (*Compt. rend.*, 1908, 147, 928—930).—This worm, which occurs in the intestine of horses, contains an oily base crystallising in prisms, yielding precipitates with general alkaloidal reagents, furnishing a crystalline picrate, and reducing auric chloride in the cold; less than 0·0001 gram produces hæmolysis in seven to eight minutes. G. B.

The Sensitising Action of Vegetable and Animal Pigments on Paramœcia. Walther Hausmann and W. Kolmer (*Biochem. Zeitsch.*, 1908, 15, 12—18).—It has been shown already that certain pigments, on exposure to light, bring about rapid hæmolysis of red blood-corpuscles. In a similar way, they can kill paramœcia. The pigments investigated were chlorophyll, animal bile from different sources, and hæmatoporphyrin. In some cases, the pigment was added in alcoholic solutions, it being determined by preliminary experiments that the alcohol had no deleterious influence in the strength used.
S. B. S.

Sugar from Colostrum. John Sebelien and Einar Sunde (*Zeitsch. angew. Chem.*, 1908, 21, 2546—2550).—The authors reply to Schiebe's criticism (Abstr., 1901, ii, 204). Independent evidence is given of the presence of lactose in colostrum, and the results of estimating this substance by the optical method and by Kjeldahl's method are compared. Differences are found of about the same magnitude and in the same direction as was observed when lactose was estimated in milk, the optical method giving higher values than the gravimetric method. It is suggested that some small quantity of arabinose causes this difference, the amount being put at about 0·05% of the colostrum. J. V. E.

Excretion of Iodine and Lithium by the Bile. E. FRICKER (*Biochem. Zeitsch.*, 1908, 14, 286—293).—After the administration of lithium iodate in doses of 1 gram by the mouth in man, the excretion of iodine by the bile reaches its maximum in the third hour. Some also leaves the body by the urine, but later. If lithium iodide is given, 0·86% leaves the body by the bile within twenty-four hours. Lithium also appears in the bile, and its excretion by this channel lasts seven hours. The excretion of the two elements does not run parallel. The observations were made on a patient with a biliary fistula. W. D. H.

Condition in which Iodine Occurs in the Urine after Ingestion of Iodides and Iodates. ELI CRESPOLANI (*Boll. chim. farm.*, 1908, 47, 679—685).—The author confirms the presence of organic iodo-compounds in the urine after ingestion of potassium iodide. Further, when alkali iodates are administered, the reduction which they undergo takes place only during the gastric digestion, and is complete when the quantities of iodate taken are not too great; this reduction is affected by the action of the peptones in a solution which is faintly acidified with hydrochloric acid. T. H. P.

The Influence of Tolylenediamine on the Cholesterol Content of the Fæces. CHOSABURŌ KUSUMOTO (*Biochem. Zeitsch.*, 1908, 14, 407—410).—Tolylenediamine has been stated to cause a destruction of the red blood-corpuscles, to which fact has been ascribed the increased amount of cholesterol found by the author in the bile of a dog with a biliary fistula. Further experiments with a normal dog show that subcutaneous injection of the drug causes also an increased excretion of cholesterol in the fæces. The increase, like that in the bile, is only transitory. S. B. S.

The Cholesterol Content of Dogs' Fæces with Ordinary Nutrition and after Administration of Cholesterol. CHOSABURŌ KUSUMOTO (*Biochem. Zeitsch.*, 1908, 14, 411—415).—With a meat diet, more cholesterol was ingested than excreted. Addition of cholesterol to the diet caused increased cholesterol excretion. The increase in the amount excreted was, however, less than the increase in the amount ingested, part disappearing presumably either through resorption in the alimentary tract or through destruction by bacteria. S. B. S.

The Content of Dogs' Fæces in Cholesterol and Coprosterol. CHOSABURŌ KUSUMOTO (*Biochem. Zeitsch.*, 1908, 14, 416—418). The acetylation number of the cholesterol isolated from fæces indicated that the crude product contained only cholesterol and coprosterol. The relative amounts of these substances found in the fæces after different diets were determined by means of the iodine number. S. B. S.

Uric Acid Excretion in Normal Man. PAUL J. HANZLIK and PHILIP B. HAWK (*J. Biol. Chem.*, 1908, 5, 355—366).—The average daily excretion of ten healthy students of ages from nineteen to twenty-nine years on a normal mixed diet containing 91·2 grams of protein (or 1·33 grams per kilo. of body-weight) was 0·597 gram. The generally accepted average is 0·7 gram. W. D. H.

Changes in the Circulation of Nitrogen Produced by Colloidal Silver Prepared by the Electrical Method. Eduardo Filippi and Leonardo Rodolico (*Chem. Zentr.*, 1908, ii, 1052; from *Arch. Farm. sperim.*, 1908, 7, 313—328).—Quantities of 5 c.c. of a reddish-brown colloidal silver solution containing 0·025—0·035% of metal were injected for eight days, partly subcutaneously and partly intravenously, into rabbits. There was a decrease in the nitrogen ingested during this period, but an increase in the nitrogen excreted, the latter being chiefly in the form of urea. S. B. S.

Hydrochloric Acid in the Stomach in Cancer. Benjamin Moore (*Bio.-Chem. J.*, 1908, 3, 449—461).—Although the lessening of free hydrochloric acid in the gastric contents of cases of cancer is not absolutely diagnostic, the author holds that it occurs in the majority of cases, in spite of the opposite results obtained by Copeman and Hake in mice. He replies to the criticisms of these authors. W. D. H.

The Occurrence of Lævulose in Diabetic Urines. Wilhelm Voit (*Zeitsch. physiol. Chem.*, 1908, 58, 122—133).—The unsatisfactory nature of both Rosin's and Borchard's tests for lævulose in urine is pointed out; they frequently give contradictory results, and sometimes positive results with normal urine. In no case of diabetic urine was the lævulose osazone obtainable. W. D. H.

Inhibiting Effect of Potassium Chloride on Sodium Chloride Glycosuria. Theo. C. Burnett (*J. Biol. Chem.*, 1908, 5, 351—355).—After glycosuria has been produced in rabbits by the injection of sodium chloride solutions, the injection of a mixture of that salt with potassium chloride (100 : 2·2) markedly lessens the amount of sugar excreted. W. D. H.

The Lipolytic Powers of Syphilitic Sera, and the Diagnostic Value of Lipolysis by Sera. Julius Citron and Karl Reicher (*Chem. Zentr.*, 1908, ii, 1197; from *Berl. Klin. Woch.*, 1908, 45, 1398—1400).—Syphilitic sera have a lipolytic power of 2·8—3·5 for monobutyrin and 0·7—1·4 for lecithin, as compared with the values 1·25—2·5 and 0·05—0·5 for normal sera. In view of the fact that Neuberg and Reicher have shown that most immune sera have a high lipolytic capacity, this high lipolytic power of syphilitic sera cannot be considered specific. S. B. S.

Anæsthesia and Paralysis Caused by Magnesium Salts. Samuel J. Meltzer and John Auer (*Amer. J. Physiol.*, 1908, 23, 141—147).—Ryan and Guthrie's view that the symptoms caused by magnesium salts are due to asphyxia (increase of carbon dioxide in the blood) is an incorrect conclusion they have drawn from a single experiment, and is entirely unsupported by analytical evidence. The magnesium salts affect the respiratory centre without any preliminary excitation, such as is caused by carbon dioxide poisoning.

W. D. H.

Antagonism of Alcohol and Carbolic Acid. ALONZO E. TAYLOR (*J. Biol. Chem.*, 1908, 5, 319—322).—As tested by its behaviour towards yeast, there is no chemical detoxication of carbolic acid by ethyl alcohol. The effect noted by surgeons, that alcohol applied to carbolised wounds checks the internal action of the phenol, must therefore depend, as Sollman has suggested, upon some physical basis. W. D. H.

Behaviour of the Three Isomeric Phthalic Acids in the Dog's Organism. CH. PORCHER (*Biochem. Zeitsch.*, 1908, 14, 351—360).—Animals received doses of the three acids *per os*, generally in small quantities at a time, over periods of several days. The urine excreted during these periods was collected, and the amounts of the phthalic acids therein estimated. It was found that phthalic acid was almost completely burnt in the organism, whereas the *iso*phthalic and terephthalic acids were recovered unchanged to the extent of 75%. No glycine conjugated acids were isolated. S. B. S.

Physiological Action of Products of Metabolism. III. Action of Scatole on the Frog's Heart. IV. Action of Indole on the Frog's Heart. B. DANILEWSKY (*Pflüger's Archiv*, 1908, 125, 349—360, 361—377).—The frog's heart was perfused with Ringer's solution containing scatole or indole. Both substances depress the activity and frequency of the heart-beat, the action being on the cardiac muscle direct. These substances are also deleterious to ciliated epithelium and low organisms. W. D. H.

Physiological Effect of Alkaloids from Hemlock (Conium maculatum). JACQUES M. ALBAHARY and KARL LÖFFLER (*Compt. rend.*, 1908, 147, 996—999).—Given hypodermically to intact guinea-pigs, these bases produce a fall of body-temperature, sometimes followed by convulsions and death. The action of *d*- and *l*-coniine is identical. The introduction of a hydroxyl group in conhydrine and in ψ-conhydrine lessens the toxicity, which is, on the other hand, increased by the double linking in the coniceines, derived from the conhydrines by elimination of water. The action of ψ-coniine (obtained by reduction of ψ-coniceine) is not identical with that of coniine. G. B.

Action of Tobacco Smoke. W. EMERSON LEE (*Quart. J. exp. Physiol.*, 1908, 1, 335—372).—Nicotine is the most important poison in tobacco smoke; pyridine bases in the quantities present are not injurious. The amount of nicotine inhaled does not depend on the amount in the tobacco, but on the form in which it is smoked. The greater the condensation area between the point of combustion and the entrance into the mouth the more nicotine is distilled off from the hot area and will be inhaled. Smoking raises the blood-pressure by vaso-constriction, accelerates the heart and respiration, and increases intestinal movements. In excess, cerebral depression may occur, and blood-pressure may be lowered to the point of collapse. These effects are chiefly seen in unpractised smokers. Prolonged tobacco smoking may induce arterial disease. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Action of Oidium lactis and Vibrio choleræ on Choline Hydrochloride. A. Ruckert (*Arch. Pharm.*, 1908, **246**, 676—691).—Brieger has stated (*Die Ptomaine*, Berlin, 1888) that certain bacteria have the property of removing a molecule of water from choline, thereby forming the toxic substance neurine, and this observation has been confirmed to a certain extent by E. Schmidt (Abstr., 1892, 219). With a view to further confirmation, the author has grown pure cultures of *Oidium lactis* and *Vibrio cholerae* in solutions of choline hydrochloride with bouillon as a nutritive medium, and finds that these decompose choline, forming ammonia and carbon dioxide, but he was unable to detect any neurine in the reaction products. T. A. H.

The Formation by Microbial Activity from Starch of Crystalline Substances which do not reduce Fehling's Solution. Franz Schardinger (*Centr. Bakt. Par.*, 1908, ii, **22**, 98—103).—The substances in question were obtained by the growth of *Bacillus macerans* in a medium, two litres of which contained 100 grams of starch, 2 grams of ammonium phosphate, 0·5 gram of magnesium sulphate, and sodium chloride. The mixture was filtered after four days' incubation, and the filtrate, which smelt strongly of acetone and was acid in reaction, was neutralised and evaporated. On cooling, a crystalline product separated, which was extracted with 50% alcohol. To the concentrated cooled alcoholic extract, ether was added. A precipitate was thereby obtained which consisted chiefly of regular, hexagonal plates; intermixed with these were aggregates of needles. The substances do not reduce Fehling's solution, and give reactions with iodine solutions. S. B. S.

Reduction of Nitrates during Alcoholic Fermentation. Giulo Paris and T. Marsiglia (*Chem. Zentr.*, 1908, ii, 966; from *Staz. sperim. agrar. ital.*, 1908, **41**, 223—232).—During the process of alcoholic fermentation, the nitrates present are found to be reduced, in varying quantity, to oxides of nitrogen. The action is sufficiently vigorous to reduce completely all the nitrates naturally present in the must; in some cases the reducing action is so vigorous that a relatively large amount of added nitrate may also be reduced, whilst in other cases the greater part remains unchanged. In these circumstances of varying intensity of reduction during fermentation, little value is to be attached to the amount of nitrate present in a wine as affording an indication of its dilution. J. V. E.

Nitrification of Calcium Cyanamide in Various Types of Soil. SANTE DE GRAZIA (*Chem. Zentr.*, 1908, ii, 1060; from *Staz. sperim. agrar. ital.*, 1907, 41, 241—257. Compare Müntz and Nottin, this vol., ii, 88).—The nitrification of calcium cyanamide differs mainly from that of ammonium sulphate in that the former substance acts injuriously on the soil micro-organisms so long as it remains undecomposed. The rate of nitrification is not particularly slow, although in comparison with that of ammonium sulphate there is some retardation; it is much quicker in clay soils and in those rich in organic matter, but not acid, than in sandy or chalky soils. The chief factors seem to be the water capacity and the absorptive power of the soils; the fermenting power is also important. E. J. R.

The Influence of Oxygen on the Decomposition of Plants (Contribution to the Study of Humus Formation). DOMENICO CARBONE and RENATO MARINCOLA-CATTANEO (*Chem. Zentr.*, 1908, ii, 1049; from *Arch. Farm. sperim.*, 1908, 7, 265—301).—The decomposition of plants is mainly brought about by *Eumycetes*, which break down the dead tissues chiefly in presence of oxygen, but also in its absence. They not only attack the intracellular pectic substances, but also the cellulose of the cell walls, and in many cases even the starch. E. J. R.

The Amounts of Calcium and Magnesium in Plant Seeds. ERNST SCHULZE and CH. GODET (*Zeitsch. physiol. Chem.*, 1908, 58, 156—161).—Analyses of the ashes of the husks and kernels of various seeds show that the husks contain relatively more calcium than magnesium, but that the kernels are richer in magnesium.

The following numbers are given:

		Per cent. of ash.	100 parts of ash contained			
			K_2O.	CaO.	MgO.	P_2O_5.
Pinus Cembra	Kernel ...	2·90	29·4	6·7	9·9	42·8
	Husk ...	—	44·9	12·6	11·0	3·2
Lupinus angustifolius...	Kernel ...	3·78	31·4	5·0	10·6	40·5
	Husk ...	—	27·5	38·7	9·4	6·1
Cucurbita Pepo	Kernel ...	3·67	18·8	1·1	19·0	55·8
	Husk ...	—	35·0	8·5	7·6	6·4
Ricinus communis	Kernel ...	3·64	—	4·0	19·8	31·9
	Husk ...	—	23·7	43·9	4·3	0·6
Helianthus annus	Kernel ...	3·66	—	5·0	17·9	—
Corylus avellana	Kernel ...	3·09	—	9·6	15·5	—
Amygdalis communis...	Kernel ...	2·86	—	12·8	13·4	—
Juglans regia	Kernel ...	2·40	—	3·0	11·5	—

J. J. S.

The Nutritive Effect of Amides on the Germinating Seed, the Detached Embryo, and the Green Plant. JULES LEFÈVRE (*Compt. rend.*, 1908, 147, 935—937).—The author has shown already (Abstr., 1905, ii, 648) that green plants can develop perfectly and construct all their organic matter from tyrosine, leucine, oxamide, alanine, or glycine, without being supplied with any carbon dioxide whatever. He now shows that maize seeds will germinate and the young plant grow and increase in weight under the same conditions, whilst the detached embryos of *Pinus pinea* will not; the latter, however, develop in a solution of sucrose. E. J. R.

Transformation of Cyanogenetic Glucosides during Germination. Léon Guignard (*Compt. rend.*, 1908, **147**, 1023—1028).—Etiolated seedlings of *Phaseolus lunatus* lose in the first fortnight one-third of the phaseolunatin contained in the seed; in seedlings grown in the light, the disappearance of the glucoside is compensated for, from the tenth day onwards, by that which is synthesised in the leaves. Free hydrogen cyanide could not be detected at any stage; it appears to be used up as soon as it is set free. G. B.

The Relation between Plant Respiration and Alcoholic Fermentation. S. Kostytscheff (*Ber. deut. bot. Ges.*, 1908, **26**, *a*, 565—573).—The reactions taking place during the normal respiration of plants have not yet been worked out experimentally, although several schemes have been suggested. The author deals particularly with those hypotheses in which the production of alcohol is supposed to be an intermediate stage, namely, (1) the plant sugar gives rise to alcohol, which is then oxidised by enzymes to carbon dioxide and water; (2) the alcohol formed is not oxidised, but is assimilated by the plant; (3) the plant sugar decomposes in the same way as in alcoholic fermentation, but the reaction does not go so far as alcohol production, and the intermediate substances are oxidised.

The author's experiments were made with peas, and, in his view, they confirm the last of these hypotheses. E. J. R.

Correlations in Vegetable Metabolism. Barthold Hansteen (*Bied. Zentr.*, 1908, **37**, 788; from *Landw. Jahrb.*, 1908, 262).—Under normal conditions, every plant assimilates potassium, magnesium, and phosphoric acid in such a manner that each organ of the plant contains at all times the optimum amounts, the amounts varying with different plants and different organs and according to the period of growth. The single specific optima show certain variations; exclusive addition of one of the substances modifies the process of nutrition, which, however, again becomes normal when the usual conditions are restored. N. H. J. M.

Glycogen of Ascomycetes and its Relaton to Trehalose. Vladimir A. Tichomiroff (*Arch. Pharm.*, 1908, **246**, 582—591).—The investigations of Clautriau, Errera, and others having shown that glycogen probably serves as a reserve material, and for this purpose is first hydrolysed into sugars, it becomes of interest to investigate the relationship in the fungi of glycogen and trehalose, the latter being the characteristic sugar of this class of plants. In all cases the distribution of glycogen was determined mainly by staining microscopic preparations with iodine, and the distribution and nature of the sugars by Senft's micro-chemical method with phenylhydrazine in glycerol (Abstr., 1904, ii, 595).

The young asci of *Terfezia transcaucasica* show much glycogen and the fully ripe ones scarcely any. With Senft's reagent, yellow spherulites of trehalosephenylosazone are formed. Similarly, *T. Boudieri* gave minute spherulites of osazone after two months, and a preparation kept in Fehling's solution showed slight reduction in the neighbourhood of some of the cell contents. *T. Leonis* was found to be rich in glycogen, especially the fructification, and in this case osazone crystals appeared after a month. *Choiromyces meandriformis, Hydnotria carnea, Tuber melanosporum, T. brumale, T. rufum, T. Borchii, T. maculatum, T. magnatum, T. aestivum*, and *T. excavatum* were also examined. The first, second, and seventh were found to contain glycogen, and also yielded spherulites of osazone after about one month, especially in the stalks and contents of the young asci. The other species mentioned had all developed ripe spores and contained no glycogen, but they formed small amounts of osazone crystals after two or three months' treatment with Senft's reagent. A preparation of *T. melanosporum* showed no reduction when warmed in Fehling's solution.

The algæ *Nostoc pruniforme* and *Fucus platycarpus* were also examined, and yielded, after two months, crystals of the same phenylosazone, which may be that of dextrose, galactose, or fucose.

T. A. H.

Occurrence of Glycyrrhizic Acid in Plants. ALEXANDER TSCHIRCH and S. GAUCHMANN (*Arch. Pharm.*, 1908, **246**, 558—565. Compare Abstr., 1908, i, 898).—In extension of previous work on the isolation and characterisation of the glycyrrhizic acid of liquorice root, the authors have investigated the sweet root of *Periandra dulcis* and the bark of *Pradosia lactescens*, and find that these also contain glycyrrhizic acid, although from the second of these products it was obtained in the form of a *dihydrate*. The method of preparing the acid described by Tschirch and Cederberg (Abstr., 1907, i, 545) is not applicable in the case of the bark of *Pradosia lactescens*, or in those of the root of *Abrus precatorius* and the rhizome of *Polypodium vulgare*, in which glycyrrhizic acid also occurs. T. A. H.

Physiological Mechanism of the Coloration of Red Grapes and of Autumn Leaves. J. LABORDE (*Compt. rend.*, 1908, **147**, 993—995. Compare Abstr., 1908, ii, 774).—Certain tannins, such as gallotannin, which are not transformed into a red colouring matter by heating with hydrochloric acid (*loc. cit.*), nevertheless yield such a pigment by exposure to light in hydrochloric acid solution in the presence of formaldehyde. The latter substance, often assumed to occur in plants, is compared to a ferment; the hydrochloric acid merely produces a favourable medium, and the absence of pigmentation in white grapes is regarded as due to an unfavourable medium.

G. B.

Alkaloids of the Tubers of Corydalis cava. ERNST SCHMIDT (*Arch. Pharm.*, 1908, **246**, 575—582).—The isolation of protopine and dehydrocorydaline from the tubers of *Corydalis ambigua* (Abstr., 1908, i, 825) and *C. Vernyi* (*ibid.*, 908) has led the authors to re-examine the tubers of *C. cava* for these alkaloids (compare Abstr., 1897, i, 174; 1898, i, 604). Haars has already shown that the stem and leaves of *C. cava* do not contain protopine (Abstr., 1905, i, 462). Dehydrocorydaline was obtained and identified by means of the aurichloride and by its reduction to *i*-corydaline. An alkaloid which may be protopine was obtained mixed with bulbocapnine, from which it could not be separated. No protopine could be obtained from the seeds of *C. nobilis* or *C. lutea.* T. A. H.

Analysis of the Tubercule of Dioscorea macabiha from Madagascar. Émile Bourquelot and Bridel (*J. Pharm. Chim.*, 1908, [iv], 28, 494—500).—The tubercules of this plant, which are reputed to be poisonous, contain no alkaloid or glucoside hydrolysable by emulsin. Starch, sucrose, a reducing sugar, and three enzymes, invertase, amylase, and an anæroxydase, were detected. The toxicity may be due to a toxin. T. A. H.

Oils from Lycopodium, Ergot, Areca Nut, and Aleurites cordata Seed. Arnold Rathje (*Arch. Pharm.*, 1908, 246, 692—709).—Authentic specimens of these oils have been examined with the view of establishing their chief constants and their composition. The methods of investigation employed are given in detail in the original.

Lycopodium contains 49·2% of a greenish-yellow oil, which is acid in reaction, and has D 0·93617, n_D 1·4671, saponification number 195·0, acid number 18·6, iodine number 81·0, Hehner number 88·0, Reichert-Meissl number 7·3, and true acetyl value 44·1. The mixed fatty acids have m. p. 39—40°, neutralisation value 202·0, and iodine number 91·8. The percentage composition of the oil is lycopodoleic acid 81, lycopodic acid (dihydroxystearic acid) 3·2, stearic acid 1·13, palmitic acid 0·85, myristic acid 2·0, glycerol 7·8, unsaponifiable matter 0·43, and inorganic matter 0·03 (compare Langer, Abstr., 1889, 741, 1059).

Ergot oil is dark brown in colour with a slightly irritant taste. Its constants in the order given above for lycopodium oil are D 0·9250, n_D 1·4685, 179·3, 11·38, 74·0, 96·25, 0·63, 27·44, and for the mixed fatty acids m. p. 38—39°, 183·0, 77·2. The percentage composition of the oil is oleic acid 68, hydroxyoleic acid 22, palmitic acid 5, unsaponifiable matter 0·35, inorganic matter 0·2, alkaloid 0·6, and glycerol 7·5 (compare Mjöen, Abstr., 1896, ii, 506).

Two samples of areca nut fat were examined, the first having been extracted by ether (*A*), and the second by light petroleum (*B*). The constants in the order given under lycopodium oil are as follows; those for sample *A* are given first in each case. Oil, D = 0·884, 0·973; m. p. 36—37°, 37—38°; 227·4, 234·6; 91·1, 97·2; 24·3, 12·3; 92·76, 91·45; 0·2, 4·2; 11·2, 9·81; mixed fatty acids, m. p. 39°, 39—40°; 229·6, 235·5; 25·95, 13·6. The percentage composition of the mixed fatty acids in the two cases was lauric 43·6, 53·3; myristic 21·0, 24·7; palmitic 3·1, 24·7; stearic 2·25, 3·3; oleic 29·0, 14·5; decoic 1·0, 1·0. Sample *B* also yielded traces of hexoic and octoic acids. The other constituents of the two fats in percentages were unsaponifiable matter 1·0, glycerol 5·0, and inorganic matter 0·02—0·03, and some phytosterol.

Two samples of oil from the kernels of *Aleurites cordata* (T'ung oil) were examined, the one of Chinese (No. I), and the other of Japanese (II), origin. The constants in the usual order and with those of No. I first in each case were: *oil*, D 0·9383, 0·9393; n_D 1·503, 1·504; 191·5, 189·9; 10·4, 2·1; 156·2, 153·2; 96·05, 96·48; 1·04, 0·55; 10·5, 13·42; *mixed fatty acids*, m. p. 39—40°, 40—41°; 189·4, 188·0; 163·4, 160·3. The percentage composition of the oils was fatty acids 95·6, 96·0; glycerol 9·5, 8·7; unsaponifiable matter 0·45, 0·48, and inorganic matter 0·001 and *nil*. In both cases the fatty acids consisted of elæomargaric acid 75%, and oleic acid 25% (compare Abstr., 1898, i, 628; 1899, i, 864). T. A. H.

Composition and Toxicity of Ibervillea sonoræ. JULIA T. EMERSON and WILLIAM H. WELKER (*J. Biol. Chem.*, 1908, **5**, 339—350).—The tuber of this plant contains proteins, carbohydrates (woody fibre, with small amounts of sugar and starch), fat, cholesterol, lecithin, and salts. It is used as a cathartic, and in large doses is stated to be poisonous. No alkaloid was found, and the substance responsible for its action was not discovered. W. D. H.

Soils of Acid Reaction. YOSHINAO KOZAI (*Chem. Zeit.*, 1908, **32**, 1187).—The author cites an instance of a peculiar acid-reacting soil in Nischigahara, near Tokio. It contains hydrated silicates, more especially clays, and when a sample quite free from humus is washed with water, the acidity of the soil remains unchanged and no soluble acid is dissolved out, but, after the addition of a soluble neutral salt, such as potassium chloride or ammonium sulphate, a soluble acid is at once detected.

The potassium or ammonium appears to be absorbed by the clay, causing liberation of hydrochloric or sulphuric acid, and consequently, after dressing such a soil with potassium or ammonium manures, worse results are obtained than previously. J. V. E.

Fixation of Ammonia by Zeolites in Soils. THEODOR PFEIFFER, ALBERT HEPNER, and L. FRANK (*Bied. Zentr.*, 1908, **37**, 722—723; from *Mitt. landw. Inst. k. Univ. Breslau*, 1908, **4**).—Barley followed by oats were grown in pots in sand manured with blood meal, ammonium sulphate, and minerals, and in similarly prepared pots with different amounts of calcium carbonate and calcium zeolite (prepared by treating apophyllite with calcium chloride) respectively.

It was found, as in previous experiments (*Bied. Zentr.*, 1905, 510), that the absorbed ammonia was held so firmly by the calcium zeolite that it was only partly available for the second period of vegetation.

N. H. J. M.

Sodium Chloride Experiments with Mangolds. HERMANN BRIEM (*Bied. Zentr.*, 1908, **37**, 731—732; from *Deut. landw. Presse*, 1907, **89**).—Application of sodium chloride (2 cwt. per hectare) in addition to superphosphate and sodium nitrate increased the yields of three varieties of mangolds (roots) and also the amount of sugar as compared with superphosphate and nitrate only. The amount of leaf was considerably increased in the case of the more leafy variety, but slightly reduced in the case of the less leafy roots (Eckendorfer).

N. H. J. M.

The Impurities of Chili Saltpetre. The Possibility of Using a Less-refined Saltpetre. SANTE DE GRAZIA (*Chem. Zentr.*, 1908, ii, 1199; from *Staz. sperim. agrar. ital.*, 1907, **41**, 258—269).—The author finds that the common impurities of Chili saltpetre (sodium chloride and magnesium sulphate) are beneficial to vegetation whether applied alone or in conjunction with the pure nitrate. Potassium iodide is without effect. A less-refined saltpetre (not containing potassium perchlorate, however) might therefore be used for manure.

E. J. R.

Manurial Experiments with Two Commercial Forms of Calcium Cyanamide, Sodium Nitrate, and Ammonium Sulphate applied to Mangolds. RICHARD OTTO (*Bied. Zentr.*, 1908, **37**, 787; from *Deut. landw. Presse*, 1908, **35**, No. 1).—Ammonium sulphate and "stickstoffkalk" gave the highest results (991 and 984 cwt.), then "kalkstickstoff" (891 cwt.), and lastly, sodium nitrate (864 cwt.). The yield without nitrogen was 553 cwt. per hectare.

N. H. J. M.

The Employment of Calcium Cyanamide in Agriculture. ACHILLE MÜNTZ and P. NOTTIN (*Compt. rend.*, 1908, **147**, 902—906; compare Sante de Grazia, this vol., ii, 83).—The authors have studied the nitrification of calcium cyanamide in the soil, and find that the process varies somewhat with the amount present, but is, in the main, quite comparable with the nitrification of ammonium sulphate. Sufficient of each of these substances was mixed with soil to add 0·25 gram of N per kilo., and the quantity of nitrate produced per kilo. after definite intervals was found to be:

	8 days.	15 days.	33 days.	2 months.	3½ months.	Relative amounts of nitrate at the end of 5 months.
Calcium cyanamide..	–0·003	–0·011	0·020	0·068	0·204	100
Ammonium sulphate	0·039	0·149	—	—	0·247	88
Dried blood............	0·048	0·111	—	—	0·154	66
Torrified leather......	0·003	0·024	—	—	0·037	26

The large amount of cyanamide used in this experiment (10 to 20 times the quantity customary in practice) at first inhibited nitrification, and even caused some denitrification, but later on exercised no disturbing effect. Smaller amounts had no inhibiting effect; indeed, by successively adding small quantities to the soil, it is possible for large amounts to become nitrified, especially in soils where nitrification is vigorous.

Numerous field trials are recorded. These show that (1) calcium cyanamide gives substantially the same crop increases as ammonium sulphate; (2) it does not in practice have the injurious effect on germination that would be expected from laboratory experiments, and can without any bad results be applied to the soil on the same day as the seed is sown; (3) it can be used as a top-dressing, and the slight resulting injury to the plant is only temporary. E. J. R.

Analytical Chemistry.

A New Electrical Method for the Continuous Analysis of Gas Mixtures, and its Application to the Measurement of the Velocity of Gas Currents. ADOLF KOEPSEL (*Ber. deut. physikal. Ges.*, 1908, 6, 814—827).—The method depends on the variation of the thermal conductivity of a gas mixture with its composition. In its application, the resistance of a wire suspended in the gas to be analysed is compared with that of a second wire contained in air or a gas mixture of constant composition. Both wires are traversed by a constant current, but the difference between the thermal conductivities of the surrounding gases results in temperature differences, and consequently in differences in the resistances of the two wires, which are measured. In the apparatus which has been constructed for the continuous electrical analysis, two wires are suspended in the gas to be analysed and two in the standard gas, and these are arranged so as to form the arms of a Wheatstone bridge. The method is recommended for the analysis of generator gas, flue gases, and mine gases.

In the actual apparatus, elaborate precautions are taken to avoid disturbances resulting from the action of the gas currents on the heated wires. The heated wires are so sensitive to the movements of gases that the arrangement may be utilised for the measurement of very slowly moving air-currents.

Some observations relating to the sensitiveness of the electrically-heated wires for different loads are communicated. For the wires used by the author, all the gases and gas mixtures examined were found to exhibit maximum sensitiveness when currents ranging from 0·30 to 0·34 ampere were passed through them. This variation in the current corresponded with a temperature range of 180° to 320°. H. M. D.

The Mercury Bath, a Too-little Known, Useful Expedient in Gas-analytical Work. ALFRED STOCK (*Ber.*, 1908, 41, 3834—3849).—The original contains a detailed, illustrated description of a mercury-bath, specially adapted for gas analysis, together with directions for working with it. W. H. G.

Gasometric Work by means of V. Meyer's Vapour Density Principle. JULIUS MAI (*Ber.*, 1908, 41, 3897—3904. Compare Abstr., 1903, ii, 98).—The method has now been simplified, and the sources of error reduced, so that it may be employed in actual practice. The bulb is placed near the outlet tube, and the constant temperature maintained by boiling xylene, toluene, aniline, or water. The asbestos cartridge has been displaced in favour of a glass tube, 27—35 mm. × 6 mm., provided with one to two holes 4 to 6 mm. from the top. The results obtained from calcium, strontium, and barium carbonates are in accordance with the theoretical; magnesium carbonate gives low results. W. R.

Tap Pipettes. Bernhard Tolmacz (*Zeitsch. angew. Chem.*, 1908, 21, 2551).—The pipette is surmounted by a tap so bored that the interior of the pipette may be in communication with the outside air, or with the suction tube, or with neither, according as it is turned. Tap pipettes with more than one bulb are found advantageous where several small quantities of the same liquid are to be measured out; thus the contents of the upper bulb, between two graduations on the stem, may be accurately measured out, and then the contents of the second bulb. J. V. E.

Burette for Calibrating Measuring Flasks. A. Mulder (*Chem. Weekblad*, 1908, 5, 830—831).—The burette consists of a fairly narrow tube with a large bulb, and below it a smaller bulb, a side-tube being sealed on below the smaller bulb, and a glass stopcock below the side-tube. Above the larger bulb is a zero mark, between the two bulbs a 100 c.c. mark, and below the smaller bulb a 110 c.c. mark. Above and below the last two marks there are a number of divisions corresponding to tenths of a c.c. The portion of the tube below the stopcock is capillary, to admit of the introduction of the water into the flask without wetting the neck of the latter. Water is introduced into the burette from a bottle at a higher level through the side-tube and a tube fitted with a pinchcock. The apparatus is suitable for the calibration of measuring flasks intended to contain any multiple of 100 or 10 c.c. A. J. W.

An Indicator Highly Sensitive towards Alkali and Suitable for Titrations with Continormal Solutions. Erwin Rupp and R. Loose (*Ber.*, 1908, 41, 3905—3908).—The authors find that p-*dimethylaminoazobenzene*-o-*carboxylic acid*,

$$CO_2H\cdot C_6H_4\cdot N\colon N\cdot C_6H_4\cdot NMe_2,$$

surpasses other indicators, and especially hæmatoxylin and iodoeosin, when used in the titration of very dilute solutions (up to *N*/100) of weak bases (especially vegetable alkaloids). The indicator, to which is given the name "methyl-red," is prepared by combining a diazotised solution of *o*-aminobenzoic acid with dimethylaniline in alcoholic solution, and crystallises from acetic acid in glistening, violet needles. Its colour in alkaline or neutral solution is pale yellow, and in acid solution, violet-red. J. C. C.

Burette for the Analysis of High-Grade Oxygen. H. Murschhauser (*Zeitsch. angew. Chem.*, 1908, 21, 2503—2504).—A combination of two gas burettes of the Zuntz-Geppert type, surrounded by a water jacket; one serves as a thermobarometer, whilst into the other is introduced in the usual manner about 100 c.c. of the sample, which may be measured to 1/50 c.c. By means of Hempel pipettes containing aqueous potassium hydroxide and alkaline sodium hyposulphite, the carbon dioxide and oxygen are absorbed, and the remaining gas consists of nitrogen. L. DE K.

Detection of Hydrogen Peroxide, Formaldehyde, and Persulphates. S. ROTHENFUSSER (*Zeitsch. Nahr. Genussm.*, 1908, 16, 589—591).—Hydrogen peroxide may be detected in milk by adding about 10 drops of 2% alcoholic benzidine solution and a few drops of acetic acid to 10 c.c. of the milk; a blue coloration is obtained if hydrogen peroxide is present. For the detection of hydrogen peroxide in liquids other than milk, it is necessary to add a little milk serum as well as the reagents, as the coloration is obtained only in the presence of the protein. Persulphates give a blue coloration with the benzidine solution alone, and 1 part of persulphate in 1,000,000 may be detected by this means. Formaldehyde may be detected in milk by warming a portion of the milk with twice its volume of concentrated hydrochloric acid to which has been added 2 drops of a 2% solution of a molybdenum, uranium, cobalt, silver, mercury, or copper salt; a violet coloration being produced in the presence of formaldehyde. W. P. S.

Analysis of a Solution containing a Mixture of Sulphides, Hydrogen Sulphides, Polysulphides, and Hyposulphites. F. DHUIQUE-MAYER (*Chem. Zentr.*, 1908, ii, 1124—1125; from *Rev. gen. Chim. pure. appl.*, 1908, 11, 273—274).—Ten c.c. of the solution are diluted to 100 c.c., and 10 c.c. of this again diluted to 200 c.c. and titrated with $N/10$ sulphuric acid, using phenolphthalein as indicator (A). The liquid is next titrated with $N/10$ iodine, using starch as indicator (I). After decolorising the liquid with a small drop of the solution, it is again titrated with $N/10$ sodium hydroxide until pink (R). Another 10 c.c. of the solution are diluted and shaken with 2 grams of lead carbonate, and the filtrate is titrated with $N/10$ iodine, which now only gives hyposulphite (H). $A =$ sulphides, $R =$ total sodium hydrogen sulphide, $R - A =$ true sodium hydrogen sulphide, $I - 2R =$ polysulphide and hyposulphite, $H =$ hyposulphite, $(I - 2R) - H$ $=$ polysulphide. The coefficients used in the calculation are the tenth-part of the molecular weights; in the case of polysulphides, the titre is divided by 2, and the result is expressed as sodium disulphide.
L. DE K.

Estimation of [Ammoniacal] Nitrogen. FRITZ TAURKE (*Chem. Zeit.*, 1908, 32, 1176).—The usual plan is to distil 50 c.c. of the usual solution ($=1$ gram of the sample) with magnesia; the distillate is collected in a receiver containing 50 c.c. of $N/2$ acid, and the excess of this is titrated with $N/4$ alkali. The amount of nitrogen is then calculated from the formula $(50 - a)/2 \times 0{\cdot}007 \times 100 =$ percentage.

In order to facilitate the operation, the author starts with 35 c.c. of the solution ($= 0{\cdot}7$ gram of the sample), and titrates from a burette graduated to 0·1 c.c. from 25° at the top to 0° at the bottom. The number read off then at once gives the percentage of ammoniacal nitrogen. L. de K.

New Mercury Nitrometer. C. Alberte Garcia (*Bull. Soc. chim.*, 1908, [iv], 3, 1111—1114).—The point for which novelty is claimed in this apparatus is the device for eliminating all the air from the burette before the reaction is started. The nitrometer consists of a burette provided with a stopcock, *A*, communicating with a cylindrical reservoir of the usual pattern at the upper end, and terminating below in a cylindrical bulb of 40 c.c. capacity, which communicates laterally at its upper end with a glass funnel serving as a water reservoir, and at its lower end with a reservoir of mercury. The water and mercury reservoirs connect with the burette by flexible tubing and can be used for levelling purposes, and their connexions with the burette are controlled by stopcocks *B* and *C* respectively. In using the apparatus, the water reservoir and its connexion are filled with boiled distilled water, of which a little is allowed to run into the burette. The stopcock *B* is then closed, and the burette filled with mercury by opening stopcocks *A* and *C*. Stopcock *A* is then closed. By lowering the mercury reservoir, a reduced pressure space is created in the burette, so that solutions of reacting ingredients can be sucked in through *A*. At the termination of the reaction, water can be added through *B*, and the resulting gas, saturated with water vapour, measured in the burette in the usual manner.

T. A. H.

Volumetric Estimation of Water-Soluble Phosphoric Acid in Superphosphates. Ludwig Schucht (*Chem. Zeit.*, 1908, 32, 1201—1202).—Five hundred c.c. of the aqueous solution of the superphosphate (20 grams to 1 litre) are mixed with *N*/-potassium oxalate in order to remove the calcium, but as an excess must be strictly avoided, it is best to ascertain by a special experiment how much oxalate is really required. After heating at 70° and subsequent cooling, the solution is diluted to 550 c.c., and 110 c.c. of the filtrate (= 2 grams) are titrated in presence of methyl-orange with *N*/2 alkali.

Another 110 c.c. are mixed with 25 c.c. of the oxalate solution and then titrated in presence of phenolphthalein. The following example is given. In the analysis of a superphosphate, the first titration required 2·7 c.c. alkali; the second, 11·2 c.c.; 11·2—2·7 c.c. = 8·5 c.c. × 0·0358 × 100/2 = 15·1% soluble P_2O_5. The amount of free acid = 2·7 c.c. × 0·0355 × 100/2 = 4·8% of P_2O_5. L. de K.

Estimation of Boric Acid in Insoluble Silicates. Edgar T. Wherry and William H. Chapin (*J. Amer. Chem. Soc.*, 1908, 30, 1687—1704).—*Volumetric Method* (Wherry).—0·5 Gram of the sample is fused with 3 grams of sodium carbonate for fifteen minutes. The mass is treated with 20—30 c.c. of dilute hydrochloric acid and a few drops of nitric acid, and heated nearly to boiling in a 250 c.c. round-bottomed flask. After adding a moderate excess of pure calcium carbonate, a reflux condenser is attached, and the contents are boiled vigorously for ten minutes. The precipitate is collected on a Büchner funnel, and washed with hot water. The filtrate is then returned to the flask, and, after adding a pinch of calcium carbonate, it is freed from carbon dioxide by boiling under reduced pressure; in this manner there is no fear of loss of boric acid by volatilisation.

The liquid is filtered, and rendered decidedly alkaline to phenolphthalein, when 1 gram of mannitol is added. The solution is now titrated for boric acid with standard sodium hydroxide until pink, when another gram of mannitol is added, and the titration continued if necessary. The sodium hydroxide must be titrated accurately as to its true hydroxide content; in that case, it matters not if a little carbonate should be present, as this is neutralised by the calcium chloride present.

Distillation Method [CHAPIN].—This method is briefly as follows: 0·5 gram of the borosilicate is fused with 3 grams of potassium sodium carbonate. The mass is decomposed by 12 c.c. of dilute hydrochloric acid (1 : 1), and the solution put into a distilling flask together with 12 grams of dry calcium chloride. The flask is connected with a generating flask in which methyl alcohol is being boiled, and when 25 c.c. of this have collected, heat is applied and the vapours (methyl alcohol and methyl borate) are passed through a short condenser and collected in an Erlenmayer flask to which a water trap is attached. When 100 c.c. of distillate have collected, another 100 c.c. are collected in a second receiver.

The methyl alcohol is distilled off after addition of an amount of sodium hydroxide sufficient to retain all the boric acid. The resulting solution is then titrated for boric acid as usual, using either glycerol or mannitol as a medium. L. DE K.

Combustion Analysis. JAMES WALKER and THOMAS BLACKADDER (*Proc. Roy. Soc. Edin*, 1908, 28, 708—712).—The dimensions of the tube used for copper oxide combustions have been reduced so as to secure the advantages of the Dennstedt furnace, and to make this method of analysis more suitable for students working at an ordinary laboratory bench. A furnace of the Dennstedt pattern, but only 60 cm. in length, and a Jena glass combustion tube, 66 cm. long and not more than 8 mm. internal diameter, are employed. The tube is charged with coarsely-powdered copper oxide, and the substance to be analysed, also mixed with copper oxide, is burnt in a moderately rapid current of oxygen at a dull red heat. Details are given for carrying out combustions of compounds containing nitrogen, and also volatile substances, such as benzene, the results obtained in each case being very good. A combustion tube of the same dimensions may also be used for estimating nitrogen by the direct method with equally satisfactory results. J. V. E.

The Use of Sodium Peroxide for the Quantitative Analysis of Organic Compounds. III. HANS PRINGSHEIM (*Ber.*, 1908, 41, 4267—4271. Compare Abstr., 1904, ii, 447; 1905, ii, 609).—A modification of the older method is described.

Substances containing 75% or more of C + H + S require eighteen times their weight of peroxide, and those with 50—75% C + H + S, sixteen times. Substances containing 25—50% C + H + S are mixed with half their weight of a compound rich in C and H (for example, sugar); those with less than 25% C + H + S, with their own weight of the compound rich in C and H. The first of these mixtures is used with sixteen times its weight of peroxide, and the second with eighteen times its weight.

The admixing is carried out in an iron crucible by means of an iron nail. The lid is placed on the crucible, which is introduced into a dish containing cold water. The iron nail is raised to a red heat, and introduced through the hole in the lid of the crucible. If the mixture is in the right proportions, the whole mass becomes molten and, after cooling for a few minutes, is dissolved in cold water, and sulphur, halogens, arsenic or phosphorus estimated as already described.

Excellent results can be obtained. J. J. S.

Estimation of Potassium as Phosphomolybdate. A. Schlicht (*Chem. Zeit.*, 1908, 32, 1125—1126, 1138—1140. Compare Abstr., 1907, ii, 130).—About 0·1 gram of potassium sulphate, free from ammonium salts, is mixed with 10 c.c. of the author's reagent and evaporated to dryness. The residue is taken up with 10 c.c. of hot 5% solution of magnesium sulphate, and when cold the precipitate is collected on a weighed asbestos filter and washed first with 10 c.c. and then with 5 c.c. of 5% magnesium sulphate, then again three times with 5 c.c. of 5% ammonium nitrate, and finally with alcohol and ether. 0·1 Gram of pure potassium sulphate thus treated yields 0·8071 gram of dry, and 0·7860 gram of ignited, residue.

The reagent is prepared as follows: 100 grams of molybdic acid are dissolved in water with addition of 250 grams of crystallised sodium carbonate, the whole is evaporated to dryness, and the residue heated for two hours at 150°. It is then dissolved in water up to 500 c.c. Meanwhile, 6 grams of magnesium pyrophosphate are dissolved in boiling nitrohydrochloric acid, and then evaporated repeatedly with nitric acid to expel the chlorine. The residue is dissolved in a little water and nitric acid, D 1·36, and diluted to 500 c.c. with acid of the same strength. To this is then added gradually and with stirring the molybdate solution, also another 500 c.c. of water, and, after standing for two hours, the liquid is filtered. L. de K.

Volumetric Estimation of Potassium in Animal Fluids. W. A. Drushel (*Amer. J. Sci.*, 1908, [iv], 26, 555—562[*]).—The process has been described previously (Abstr., 1908, ii, 66). The only modification is that the "cobalt-yellow" is washed with weak brine (1 : 1) instead of with water; this permits the use of a coarser asbestos felt without danger of loss. It is then titrated with $N/10$ permanganate as usual.

Potassium in Urine.—Ten to fifty c.c. of the sample are evaporated to dryness in a small platinum dish, and the residue is heated with 5—10 c.c. of a mixture of nitric and sulphuric acids (9 : 1); when the first violent action is over, the acid is expelled and the residue

[*] and *Zeitsch. anorg. Chem.*, 1909, 61, 137—146.

ignited. The residue is then dissolved in a little water and a few drops of acetic acid, and, without previous filtration, the liquid is treated with the sodium cobalt nitrite reagent as directed.

Potassium in Circulatory Fluids.—In this case the mass (blood, serum, lymph) is oxidised with nitric acid alone, and the residue is heated, but not strongly enough to cause an explosive decomposition. The mass is then heated with sulphuric acid and finally ignited. In the case of defibrinated blood, this may be treated with about 2 c.c. of bromine, and, after an hour, it is evaporated to dryness and charred. The mass is then extracted with hot water, and the solution evaporated to dryness after adding a little sulphuric acid.

Potassium in Milk.—The milk is evaporated to dryness, and the residue treated with nitric acid. The whole is evaporated to dryness, and ignited to burn off most of the organic matter. The residue is then moistened with sulphuric acid, and once more ignited.

L. DE K.

The Determination of Calcium Carbonate in Soils by the Methods of Bernard and of Treitz, and its Significance in the Selection of Soils [for Vineyards]. KARL VOTRUBA (*Chem. Zentr.*, 1908, ii, 1065; from *Allgem. Wein-Zeit.*, 1908, No. 30).—Bernard's method consists in gently powdering the soil, passing it through a 0·3 mm. sieve, and determining the carbon dioxide evolved in a calcimeter from the fine soil. In Treitz's method, the soil is stirred with water, allowed to settle for half a minute, decanted and allowed to settle for half an hour, and the carbon dioxide given off from the deposit on treatment with acid determined. The two methods did not give concordant results in the author's tests, but, in general, it appears that the amount of carbonate in the fine soil is more important than that present in coarse lumps. Other properties of the soil, however, have to be taken into account in selecting soils for vineyards.

E. J. R.

Detection of Poisonous Metals. GEORGE D. LANDER and H. W. WINTER (*Analyst*, 1908, 33, 450—452).—The following methods are suggested for a rapid and simple qualitative search for poisonous metals in organic substances, such as viscera, etc. A Reinsch test is first made for arsenic, antimony, bismuth, and mercury; if a deposit is obtained on the copper foil, numerous methods are available for its further examination. A portion of about 50 grams of the sample is then treated with 50% nitric acid (in quantity sufficient to cover the substance), from 5 to 10 c.c. of concentrated sulphuric acid being also added. The mixture is heated until dense brown fumes are evolved, diluted, and filtered. The filtrate is rendered strongly alkaline with ammonia, a slight excess of ammonium sulphide is added, and the precipitated phosphates, chromium hydroxide, and iron, lead, mercury, copper, bismuth, and zinc sulphides are collected on a filter and washed. The metals are thus obtained practically free from organic matter, and may then be separated and identified by known methods.

W. P. S.

Microchemical Analysis. IV. Mercury, Bismuth, Lead, Copper, Cadmium. NICHOLAS SCHOORL (*Zeitsch. anal. Chem.*, 1908, 47, 729—754).—The sulphides of the metals are treated with nitric acid, and the insoluble mercuric sulphide is separated; a drop of the nitric acid solution is then heated on an object glass with a drop of sulphuric acid. If, on diluting with water, a white, insoluble residue remains, it is probably lead sulphate, and its presence is confirmed by other reactions. The sulphates of bismuth, copper, and cadmium are treated with water, and, if basic bismuth sulphate remains insoluble, it is identified by the appearance of the microscopic crystals when it is converted into potassium bismuth sulphate. The solution containing the copper and cadmium is next evaporated, the residue is heated to dull redness, and treated with water; cadmium sulphate dissolves, whilst copper oxide remains undissolved. Cadmium may be identified by the shape of the crystals when it is converted into either cadmium oxalate or cadmium tetrarubidium chloride. Copper may be identified by the reaction described by Meerburg and Filippo (Abstr., 1906, ii, 52). W. P. S.

Volumetric Estimation of Lead in Ores. JOSEPH A. MULLER (*Bull. Soc. chim.*, 1908, [iv], 3, 1131—1133).—The author has examined the Schwatz volumetric process, both in the case of lead nitrate solutions of known strength, and of a mixture of known composition, including the usual constituents of a lead ore, and finds that it gives low results. These are due (1) to the adhesion of some lead sulphate (even in presence of excess of sodium acetate) to the lead chromate when this is precipitated by the standard dichromate used, and (2) in the case of the mineral mixture to the difficulty of extracting the whole of the lead, especially when the mixture contains ferric oxide, as this is liable to form with lead oxide, lead ferrate, which is attacked with difficulty by sodium hydroxide solution. Weighing the precipitated lead chromate gives better results, but it is preferable to weigh as the sulphide as recommended previously (Abstr., 1905, ii, 118, 119).
T. A. H.

Decinormal Solution of Potassium Permanganate. BERNARD COLLITT (*Pharm. J.*, 1908, 27, 724).—Experiments showing that a standard solution of potassium permanganate suffers no loss in strength for at least twelve months if kept in the dark, even although the bottle may have to be frequently opened. L. DE K.

Estimation of Chromic Acid. JOSEPH A. MULLER (*Bull. Soc. chim.*, 1908, [iv], 3, 1133—1135).—The author has examined the volumetric methods described by Carnot (Abstr., 1889, 311) and by Zulkowki. He finds that the former, which depends on the use of a standard solution of hydrogen peroxide, gives results which vary with the dilution of the solution titrated. Zulkowki's process, depending on the liberation from potassium iodide of iodine and titration of the latter with sodium thiosulphate, gives trustworthy results if no other oxidising agent is present. In the latter case, titration with a standard solution of a lead salt can generally be resorted to, but, as shown in a previous paper (see preceding page), it is safer to weigh the precipitated lead chromate. T. A. H.

Electrolytic Estimation of Nickel. August Schumann (*Zeitsch. angew. Chem.*, 1908, 21, 2579—2583).—A criticism of the methods proposed from time to time. Fresenius-Bergmann's ammonia method is free from sources of error, and, contrary to general belief, it is not interfered with by the presence of nitrates or chlorides. Brand's ammonium carbonate method also gives excellent results, but the author has not as yet tried this in the presence of nitrates and chlorides. Addition of sodium pyrophosphate is unnecessary. Classen's oxalic acid method cannot be recommended, as the nickel deposit is contaminated with carbon.

The electrolysis succeeds best by the use of a platinum-gauze cathode, a platinum spiral as anode, and a weak current. A sufficiency of ammonium sulphate should be present. L. de K.

Volumetric Estimation of Nickel with Potassium Cyanide. Hermann Grossmann (*Chem. Zeit.*, 1908, 32, 1223).—The author has applied this process to mixtures of nickel and cobalt. To the solution is added some sucrose to prevent precipitation of cobalt, and the nickel is then precipitated by means of dicyanodiamidine sulphate, ammonia, and aqueous potassium hydroxide. The precipitate is collected on a filter, and re-dissolved in warm dilute hydrochloric acid. When cold, a slight excess of ammonia is added, and the nickel is titrated with potassium cyanide as usual.

Further experiments, including the estimation of nickel in the presence of zinc, are in progress. L. de K.

Separation of Tin, Arsenic, and Antimony; Analysis of Bronzes. Dinam (*Chem. Zentr.*, 1908, ii, 1207—1208; from *Mon. Sci.*, 1908, [iv], 11, 600—602).—Three grams of the bronze are heated with 30 c.c. of nitric acid, D 1·4; the filtrate contains zinc, lead, and the greater portion of the copper; the precipitate contains arsenic, antimony, tin, and a little copper and lead. It is dissolved in a boiling solution of 10 grams of oxalic acid and 5 grams of ammonium oxalate, and, after adding a little hydrochloric acid, a current of hydrogen sulphide is passed through the hot liquid for two hours. The tin remains in solution, and may be deposited electrolytically, whilst the arsenic, antimony, copper, and lead are precipitated as sulphides. On treating with boiling aqueous potassium hydroxide, the copper and lead are left undissolved; these are then dissolved in nitric acid, and the solution added to the main acid liquid. The alkaline solution is heated with excess of hydrochloric acid, the filtrate is oxidised with potassium chlorate, and, after expelling the excess of chlorine, the antimony is estimated iodometrically with potassium iodide and sodium thiosulphate. The precipitated arsenious sulphide is dissolved in potassium hydroxide, and also estimated iodometrically in the same manner as the antimony. The acid liquid is concentrated to about 15 c.c., 3 c.c. of saturated sodium acetate are added, and the copper and lead are deposited by electrolysis; the liquid contains the zinc, which is precipitated by boiling with sodium carbonate, and finally weighed as oxide.

If the bronze should contain phosphorus, this will be found in the liquid from which the tin has been deposited electrolytically, and it may be precipitated as ammonium magnesium phosphate or ammonium phosphomolybdate. If iron should be present in the alloy, a portion of it will contaminate the zinc, and another portion remains in the liquid from the tin deposit, from which it may be precipitated with ammonium sulphide. L. DE K.

Estimation of Antimony and Arsenic in Lead-Antimony Alloys. GEO. M. HOWARD (*J. Amer. Chem. Soc.*, 1908, **30**, 1789—1790).—A slight modification of the author's process (Abstr., 1908, ii, 429). The finely-divided alloy is heated with hydrochloric acid until action ceases, the flask is removed from the hot plate, and 0·5 c.c. of nitric acid is added. As soon as the arsenic and antimony have dissolved, the liquid is boiled for some five minutes, and then treated as directed.

If the antimony does not exceed 0·1 gram, 5 grams of tartaric acid will be sufficient to prevent precipitation. If there is a large excess of lead chloride, a larger amount of sodium hydrogen carbonate should be used when titrating the arsenic; the blue colour should be permanent for at least one minute. In oxidising the arsenic, 10 c.c. of 3% hydrogen peroxide generally suffices, and the solution must be distinctly alkaline; if this is not so, as shown by separation of sulphur, a little more sodium hydroxide should be added. L. DE K.

Identification of Dihydric Phenols. A Delicate Reaction for Resorcinol. T. SILBERMANN and N. OZOROVITZ (*Chem. Zentr.*, 1908, ii, 1022; from *Bul. Soc. Sci. Bucuresci*, 1908, **17**, 41—42).—With formaldehyde in acid solution, the dihydric phenols give characteristic, resinous, insoluble condensation products. When resorcinol is heated with formaldehyde in presence of hydrogen chloride or sulphuric acid, a very voluminous, flocculent precipitate is slowly formed. The colour of this substance is very pale red, but when it is added to concentrated sulphuric acid, or heated with concentrated hydrogen chloride solution, it changes to a brilliant carmine-red, and, on the addition of water, or when neutralised, this colour changes to pale orange. The carmine-red or orange-coloured substance, in the presence of free alkali, changes to Bordeaux-red.

An acid solution of resorcinol (1 : 100,000) gives a white turbidity with formaldehyde, which becomes rose-pink on addition of hydrogen chloride, and yields a red solution on the addition of excess of sodium hydroxide.

Catechol with formaldehyde in acid solution gives a very pale yellow, flocculent precipitate, which changes when boiled with concentrated hydrogen chloride solution to a violet-brown; dilution with water, or neutralisation of the acid, changes it to a flesh-pink colour; excess of alkali produces a greenish-brown colour.

Quinol requires more acid for condensation with formaldehyde to take place; a very pale violet, flocculent precipitate is obtained, which changes to pale brown when boiled with strong hydrogen chloride solution, diluted with water, or when neutralised, and to olive-green in presence of excess of alkali. J. V. E.

The Sodium Nitroprusside Reaction for Acetone. A. C. H. Rothera (*J. Physiol.*, 1908, 37, 491—494).—The following modification of the test is recommended, creatinine not reacting in the manner described. Five to ten c.c. of a solution of acetone in water or urine are taken, and a solid ammonium salt (chloride, bromide, acetate, or carbonate) added; then 2 or 3 drops of a freshly-made 5% solution of sodium nitroprusside, and 1—2 c.c. of strong ammonia. A characteristic permanganate colour is produced. W. D. H.

Detection and Estimation of Formaldehyde in Wine Stored in Barrels which have been Disinfected with Formaldehyde. Friedrich Schaffer (*Zeitsch. Nahr. Genussm.*, 1908, 16, 674—676).—Barrels which have been treated with formaldehyde and subsequently steamed may still contain sufficient of the aldehyde to contaminate wine which is stored in them. The author has detected traces of formaldehyde in such wines by means of the test described by Arnold and Mentzel (Abstr., 1902, ii, 480). Before being tested, the wine should be distilled with phosphoric acid, and the distillate rendered alkaline with sodium hydroxide in order to decompose the aldehyde-sulphurous acid compound which distils over; after the lapse of fifteen minutes, the mixture is acidified with sulphuric acid and the test is applied. For the estimation of formaldehyde in wine, the latter is distilled with phosphoric acid until the volume of the distillate is about three-fourths of that of the quantity of wine taken. The distillate is rendered alkaline with sodium hydroxide, and, after fifteen minutes, is exactly neutralised with sulphuric acid, using rosolic acid as indicator. The neutral solution is then shaken with a slight excess of $N/1$ ammonia (about 2 c.c. are usually sufficient), and at the end of three hours the excess of ammonia is titrated with $N/10$ sulphuric acid. The estimation depends on the combination of the ammonia with the aldehyde according to the equation:

$$6CH_2O + 4NH_3 = C_6H_{12}N_4 + 6H_2O.$$

W. P. S.

Colorimetric Method for the Estimation of Formaldehyde in Milk. Edward W. T. Jones (*Chem. News*, 1908, 98, 247).—The method depends on the coloration produced when a mixture of milk, formaldehyde, and hydrochloric acid containing a small quantity of ferric chloride is heated. The reagent is prepared by dissolving 0·25 gram of pure iron wire in hydrochloric acid, oxidising the ferrous salt with nitric acid, and precipitating the iron as ferric hydroxide by the addition of ammonia; the precipitate is collected on a filter, washed, and then dissolved in 500 c.c. of concentrated hydrochloric acid. Ten c.c. of the sample of milk containing formaldehyde and 10 c.c. of the reagent are heated together for twenty-five minutes at a temperature of about 80°; 30 c.c. of water is next added, and, when cold, the mixture is passed through a filter, the precipitate washed with a little water, and the filtrate is diluted to a volume of 100 c.c. The blue colour of the filtrate is then compared with the colorations obtained by similarly treating quantities of pure milk to which have been added known amounts of formaldehyde. W. P. S.

Characteristic Reaction of Uric Acid. Domenico Ganassini (*Boll. chim. farm.*, 1908, 47, 715—726).—The author gives the following test for the presence of uric acid or a urate, which is not disturbed by the presence of proteins, and is not given by xanthine, hypoxanthine, caffeine, theobromine, theophylline, heteroxanthine, paraxanthine, 1 : 7-dimethylhypoxanthine, 3-methylxanthine, carbamide, alloxan, alloxantin, allantoin, creatine, creatinine, glycine, tyrosine, leucine, hippuric acid, nuclein, nucleic acid, or the bile acids.

To a small quantity of uric acid or a urate dissolved or suspended in water, 10% sodium hydroxide solution is added until the whole is dissolved, giving a distinctly alkaline solution. Subsequent saturation of the liquid with potassium persulphate, and gradual addition of 10% aqueous zinc sulphate until the precipitate formed no longer redissolves, causes the precipitate to assume a bluish-green colour. The reaction is shown distinctly by 10—20 c.c. of a 0·01% solution of uric acid, and is still more sensitive if carried out directly on solid uric acid or a solid urate, or the precipitated double urate of silver and magnesium.

The reaction may be applied to the detection of uric acid in urine in the following manner: Three c.c. of 10% sodium hydroxide solution are added to 10% of urine and the liquid filtered, 5 c.c. of the filtrate being treated with 2 c.c. of 10% aqueous zinc sulphate. The gelatinous white precipitate formed, when mixed on the filter with a little potassium persulphate, will assume a bluish-green colour if uric acid is present.

In blood, traces of uric acid may be detected as follows: A few c.c. of blood-serum are well mixed with one-half the volume of freshly-prepared Salkowski-Ludwig reagent, and left for about twelve hours in the dark. The faint white or grey precipitate is collected and washed five or six times with water on a small filter, being kept as far as possible away from the light. A little powdered potassium persulphate and 2 or 3 drops of 10% sodium hydroxide solution are then applied to the precipitate, in which a bluish-green colour indicates the presence of uric acid.

By this means the author has detected, although not in all cases, traces of uric acid in the blood of the ox and horse. The blood-serum of birds is also found to contain uric acid, which is further met with in samples of blood from healthy and diseased human beings.

T. H. P.

Iodometric Estimation of Uric Acid [in Urine]. Fernand Repiton (*Chem. Zentr.*, 1908, ii, 1129; from *Rev. gen. Chim. pure appl.*, 1908, 11, 285—286).—Twenty c.c. of urine are mixed with 5 c.c. of acetic acid, and 20 c.c. of copper tartrate solution, which has been bleached by means of a saturated solution of ammonium sulphite, are added. The copper solution should be standardised iodometrically. After the cuprous urate has settled, the liquid is made up to 100 c.c., and an aliquot portion of the filtrate is taken to ascertain the amount of copper left in solution. In order to obtain it in the higher degree of oxidation, 4 c.c. of sulphuric acid are added, and the liquid is boiled to expel the sulphur dioxide. When cold, sodium carbonate is added until a precipitate forms, which is then redissolved by means of acetic acid. Potassium iodide is now added, and the iodine liberated titrated with standard thiosulphate. The difference in the titrations represents the uric acid. L. DE K.

Detection of Salicylic Acid in Wine, Milk, Butter, and Preserved Tomatoes. UMBERTO SAPORETTI (*Boll. chim. farm.*, 1908, **47**, 751—755).—The following modified methods, based on the coloration given by dilute ferric chloride solution with salicylic acid, are more rapid and convenient than those usually employed, and are capable of detecting salicylic acid in the dilution 1 : 80,000.

Wine.—Ten c.c. of the wine are shaken in a test-tube with a mixture of 3 c.c. of ether and 1 c.c. of light petroleum previously acidified with 10% hydrochloric acid. The ethereal solution, after separation, is allowed to flow down the side of another tube containing a very dilute ferric chloride solution, as also is a further quantity of the solvent after shaking with the wine. On evaporating the ether and light petroleum by gentle heating, the lower liquid gradually assumes the characteristic violet colour. As certain substances in pure wines may give a somewhat similar coloration, the presence of salicylic acid may be confirmed by adding a little of the coloured ferric chloride solution drop by drop to water, which then turns violet.

Milk.—Ten c.c. of the milk are heated to 60—70° with 3—4 drops of acetic acid, and the clear liquid, removed by a pipette, is run to the bottom of a beaker containing dilute ferric chloride solution; the appearance of a violet ring at the surface of contact of the two liquids indicates the presence of salicylic acid.

Butter.—Five to ten grams of the butter are melted in a porcelain capsule and poured into a test-tube, the capsule being then rinsed out with 7—8 c.c. of aqueous alcohol (1 part 95% alcohol to 4 parts of water), which is added to the test-tube. After being rendered faintly acid with 10% sulphuric acid, the butter is shaken repeatedly, warmed slightly, and then allowed to set, but not solidify. The supernatant liquid is then removed in a pipette, and run to the bottom of a beaker containing dilute ferric chloride solution. If salicylic acid is present, a violet ring appears where the two liquids meet.

Preserved Tomatoes.—To 10 grams of the material, placed in a porcelain capsule, are added a few drops of 10% sulphuric acid and about 5 c.c. of ether, the whole being well mixed. The ethereal liquid is then poured into dilute ferric chloride solution, and the operation repeated with a few c.c. of light petroleum, which is also subsequently added to the ferric chloride solution. On gradually heating the latter, if salicylic acid is present, the lower liquid slowly assumes the characteristic violet colour. T. H. P.

Bang's Method of Sugar Estimation and its Application in the Analysis of Urine. A. C. ANDERSEN (*Biochem. Zeitsch.*, 1908, 15, 76—94).—The experiments indicate that Bang's method (Abstr., 1907, ii, 136) is applicable to sugar estimations in urine. The error due to the reducing substance normally present in urine is small, and this even can be almost entirely eliminated by treatment of the urine with lead acetate or mercuric nitrate. Bang's method can also be applied to the estimation of sugar in molasses if the solutions are first clarified by the mercuric nitrate method. S. B. S.

Estimation of Reducing Sugars. PERCY H. WALKER (*Bull. Assoc. chim. sucr. dist.*, 1908, 26, 341—342).—Results of experiments are given showing that slightly higher figures are obtained when the precipitated cuprous oxide is weighed as such than when it is estimated electrolytically, or converted into cupric oxide before weighing (Abstr., 1908, ii, 902). The disadvantage of weighing the copper as cupric oxide is that the tables published by the author (Abstr., 1907, ii, 585) cannot be used. W. P. S

Estimation of Dextrose in Urine with the Weidenhaff's Fermentation Saccharometer. GEORG GREGOR (*Chem. Zentr.*, 1908, ii, 987—988; from *Zeitsch. allg. Oesterr. Apoth. Ver.*, 46, 419—420).—The author, who has successfully employed this apparatus of precision, recommends that the weight of the mercury should always be taken before each experiment, as small globules are easily lost when washing the apparatus. L. DE K.

Analysis of Camphorated Oil for Camphor Substitutes. FREDERIC W. RICHARDSON and W. WALTON (*Analyst*, 1908, 33, 463—466).—The following process is proposed for the analysis of camphorated oil in order to detect and estimate synthetic camphor, oil of turpentine, and essential oil of camphor, any or all of which may be present in addition to natural camphor. Ten c.c. of the camphorated oil are placed in a small retort, and heated to a temperature of 200° by means of an oil-bath; a current of dry carbon dioxide is passed through the retort during the heating, and the neck of the retort is connected with a weighed, two-necked Woulff's bottle. A weighed, small spiral glass condenser is fitted in the second hole of this bottle. The volatile substances collecting in the neck of the retort, the Woulff's bottle, and condenser are weighed (the neck of the retort being cut off for this purpose), dissolved in carbon tetrachloride, and the solutions are united. This solution is weighed, and portions are used for the estimation of the specific gravity, iodine number, and polymerisation with sulphuric acid. The last-mentioned process is carried out by treating a weighed portion of the solution (about one-half) with one-third of its volume of sulphuric acid, D 1·84, the acid being added slowly and the mixture cooled. The latter is then distilled in steam, and the carbon tetrachloride solution separated from the distillate and weighed; the change in specific gravity and refractive index of the solution enables the weight of the total camphors to be calculated, whilst the polarimetric reading in a

200 mm. tube, multiplied by 0·22385 and divided by 0·95, gives the amount of natural camphor. This deducted from the total camphors leaves the quantity of synthetic camphor. When the amounts of the two camphors are known, the iodine number due to turpentine and oil of camphor enables the percentages of the last-named substances to be calculated. The following iodine numbers are assumed in the calculation: natural camphor, 5; synthetic camphor, 7; essential oil of camphor, 180, and oil of turpentine, 370. W. P. S.

Gasometric Estimation of Urea. A. RONCHÈSE (*J. Pharm. Chim.*, 1908, 28, 444—452; *Bull. Soc. chim.*, [iv], 3, 1135—1141).—Ten c.c. of urine are mixed with 10 c.c. of dilute solution of basic lead acetate (100 c.c. officinal solution and 150 c.c. of water), and 10 c.c. of the filtrate, which is now free from uric acid, are treated in the usual manner with sodium hypobromite. A check experiment is then made by means of 5 c.c. of a 2% urea solution, and the volumes of nitrogen evolved are compared. If the urine contains sugar, a judicious amount of dextrose should be added to the urea solution.

If ammonium salts are present, these evolve nitrogen, which would count as urea. In accurate investigations, it is therefore necessary to estimate the ammonia separately and to calculate the result into urea. The following method is recommended: 10 c.c. of urine are diluted to 100 c.c. with water free from carbon dioxide, and a few drops of phenolphthalein are added. $N/10$ sodium hydroxide is slowly added until the liquid turns a pale rose colour. Twenty c.c. of neutralised formaldehyde (1 : 1) are now added, and the solution is titrated with $N/10$ sodium hydroxide until the liquid turns pink. A correction is made by adding 0·1 c.c. to every 3 c.c. of alkali used. The sodium hydroxide represents the ammonia. L. DE K.

Estimation of Urea in Urine. STANLEY R. BENEDICT and FRANK GEPHART (*J. Amer. Chem. Soc.*, 1908, 30, 1760—1764).—The following process is recommended: five c.c. of urine are placed in a test-tube and mixed with 5 c.c. of dilute hydrochloric acid (1 : 4). The mouth of the tube is covered with a cap made of lead foil, and it is then placed in a small autoclave, which is heated for an hour and a half at 150—155°. When cold, the contents of the tube are transferred to a 800 c.c. Kjeldahl distilling flask, 400 c.c. of water and 20 c.c. of 10% sodium hydroxide are added, and the ammonia formed is distilled and titrated as usual. Allowance should be made for pre-existing ammonia. L. DE K.

Application of the Carbamino-reaction. V. HANS LIEBERMANN (*Zeitsch. physiol. Chem.*, 1908, 58, 84—91).—Various basic substances in solution were treated in the cold with lime-water and carbon dioxide alternately in the presence of phenolphthalein, the gas being passed into the solution until the indicator was only faintly coloured. The filtered liquid was afterwards warmed to 20° with excess of lime water (and in a few cases boiled), and the calcium carbonate thus precipitated was weighed and the nitrogen in the filtrate estimated. In this way, the ratio $N : CO_2$ and the degree of completeness of the carbamino-reaction are ascertained. The ratios found were as follows: for piperazine 0·95, piperidine 0·93, coniine 1·56, tetrahydroquinoline 4·07, tryptophan 1·55, glucosamine 0·99, taurine 0·93. S. B. S.

Estimation of Vegetable Alkaloids by means of Mercuric Potassium Iodide [Mayer's Solution]. Gunnar Heikel (*Chem. Zeit.*, 1908, 32, 1149—1151, 1162—1163, 1186—1187, 1212—1213).—Mayer's reagent (6·775 grams of mercuric chloride and 25 grams of potassium iodide per litre) has been used for the estimation of alkaloids by simply adding it to the slightly acid solution so long as a precipitate is formed. The author has sensibly improved the method by adding a larger amount of the reagent than necessary, and then titrating the excess with potassium cyanide, the excess of which is, in turn, titrated with standard silver nitrate in presence of ammonia; the potassium iodide serves here as an indicator.

The author communicates a large number of experiments, showing the amount of Mayer's reagent required to precipitate 0·1 gram of the more important pharmaceutical alkaloids. The results, which in some cases depend somewhat on concentration and acidity, are not scientifically accurate, but sufficiently near the truth for pharmaceutical purposes.

When applying the process to drugs, these are, as a rule, extracted with chloroform in presence of ammonia. The solvent is then evaporated, and the residue taken up with water, acidified with sulphuric acid, and the acid solution is titrated as directed. In other cases they are simply treated with acid water. Plants are extracted with a solvent immiscible with water, and this is then shaken with acid water. For exact details of working in the assay of the various drugs and their preparations, the original paper should be consulted.

L. de K.

Behaviour of Gelatin and Proteose to Bromine Water. Ernst Salkowski (*Zeitsch. physiol. Chem.*, 1908, 57, 526—528).—The addition of bromine water to a solution of gelatin causes the formation of a sticky precipitate, which has been described as characteristic. A solution of proteose (or gelatose) behaves, however, in the same way. W. D. H.

Diazo-reaction of Atoxyl. Paul Ehrlich and Alfred Bertheim (*Chem. Zeit.*, 1908, 32, 1059).—The authors call attention to the fact that the reaction recently described by Covelli (Abstr., 1908, ii, 1000) had been described in the literature previously; compare Ehrlich and Bertheim (Abstr., 1907, i, 812); Blumenthal and Herschmann (Abstr., 1908, ii, 613), and Bertheim (Abstr., 1908, i, 591).

J. V. E.

General and Physical Chemistry.

Reflective Power of Ethyl Alcohol. Heinrich Rubens and Eric Ladenburg (*Sitzungsber. K. Akad. Wiss. Berlin*, 1908, 1140—1143). —By means of a micro-radiometer the authors have measured the reflective power of ethyl alcohol for ultra-red radiation. In order to avoid errors resulting from the absorption of the radiation in the vapour above the liquid, this was cooled to a temperature of about − 20.

The experimental data indicate the existence of selective reflection, this being more pronounced than in similar experiments at 18°. The maxima on the curve representing the reflective power as a function of the wave-length are all found to be displaced towards the visible spectrum by a lowering of the temperature from 18° to − 20°. Whether this is due to the diminution in the absorption of the alcohol vapour in contact with the liquid has not been established.

H. M. D.

Refraction and Dispersion of Krypton and Xenon and their Relation to those of Helium and Argon. Clive Cuthbertson and M. Cuthbertson (*Proc. Roy. Soc.*, 1908, *A*, 81, 440—448).—The measurements were made by a method previously described (Cuthbertson and Metcalfe, Abstr., 1908, ii, 545). The values of $(\mu-1).10^6$ for the green mercury line $(\lambda=5461)$ are for krypton and neon respectively 428·74 and 705·49. The dispersion for krypton is given by the formula $\mu-1=0{\cdot}0004189(1+6{\cdot}97/\lambda^2.10^{11})$, and that for xenon by $\mu-1=0{\cdot}0006823(1+10{\cdot}14/\lambda^2.10^{11})$, both gases being at normal temperature and pressure.

When the refractivities for infinite wave-lengths of helium, neon, argon, krypton, and xenon are compared, the numbers are found to be very nearly in the ratio 1 : 2 : 8 : 12 : 20.

If the values of b in the equation $\mu-1=a(1+b/\lambda^2)$ are plotted against the refractivities for infinite wave-lengths, a straight line can be drawn through the points representing helium, krypton, and xenon; the corresponding point for argon is also quite close. On the other hand, mercury does not fall into line with the other four monatomic elements in respect of the relationship between refractive and dispersive power.

H. M. D.

Spectroscopic Investigation of the Behaviour of Metallic Salts in Flames of Different Temperatures. Herbert Auerbach (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 30—39).—The apparatus used and details of the photographic method of registration are described. For the production of spectra corresponding with different temperatures, the Bunsen, ordinary blow-pipe, and oxygen blow-pipe flames have been employed. No experimental results are given in this part of the paper.

H. M. D.

Radiation and Temperature of the Flame of the Bunsen Burner. E. Bauer (*Compt. rend.*, 1908, **147**, 1397—1400).—The absorption and emission of certain rays by illuminating gas flames has been measured. The radiation from a source traversed a considerable thickness (3—5 cms) of a homogeneous flame, it then passed through a hole in a screen, was reflected three times from a polished surface of fluorspar, and was then examined with a micro-radiometer. The absorption, which is due to the vapour of water, is selective; a flame which absorbs only 11% of the rays emitted by a solid substance giving a continuous spectrum, absorbs 28% of the radiation from another gas flame.

From the emission and absorption measurements with the rays emitted by a solid substance, and a knowledge of the emissive power of a black substance in the same position as the flame, the temperature of the flame a little above the blue interior cone has been calculated by application of Kirchhoff's law; it amounts to 1760 ± 50°. G. S.

Extension of the Principal Series of the Sodium Spectrum. Robert W. Wood (*Phil. Mag.*, 1908, [vi], **16**, 945—947[*]).—The ultra-violet absorption spectrum of sodium vapour consists of a Balmer series of lines, of which the author has photographed thirty, this making the longest Balmer series known. In this series the *D*-lines appear as the third member, whilst the end is at λ 2411. The photographs were obtained by passing the light from a cadmium spark through a steel tube about one metre long containing sodium vapour at dull-red heat under nitrogen pressure of 15 cms. R. J. C.

Fraunhofer Lines of Thallium and an Error in Rowland's New Table of Standard Wave-Lengths. Carl Fritsch (*Physikal. Zeitsch.*, 1908, **9**, 900—901).—The author points out that Rowland's table of wave-lengths represents certain thallium lines as belonging to thorium. The spectral line measurements of thallium made by different observers are compared. H. M. D.

Re-determination of the Wave-Lengths of the Iron Lines used for Comparison Purposes. A. H. Pfund (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, **7**, 1—16).—At the instance of the International Union for Co-operation in Solar Research, the author has re-determined the wave-lengths of certain iron lines by the interference method of Fabry and Perot. Details are given of the apparatus used and of the method of mounting, silvering, and polishing the plates of the interferometer. The measurements are tabulated and compared with the results obtained by the same method by Fabry and Buisson and by Eversheim. The independent series of measurements are in very good agreement. H. M. D.

Thermal and Chemical Absorption in Banded Spectra. Johannes Stark (*Physikal. Zeitsch.*, 1908, **9**, 889—894).—The previous speculations of the author (compare Abstr., 1907, ii, 147, 417; 1908, ii, 138, 746, 911) are supplemented by a consideration of the relationships between coupled bands, of the nature of the double and triple linkings in unsaturated compounds, of the so-called oxide spectra of the metals, and of the ultra-violet absorption of saturated valency electrons.

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[*] and *Physikal. Zeitsch.*, 1909, **10**, 88—90.

In the second part of the paper, application of the author's ideas is made to photochemical phenomena. Primary and secondary photochemical changes are distinguished. Primary changes are characterised by the fact that certain valency electrons absorb more energy in the form of light than that corresponding with the energy of combination of the electrons with the atomic or molecular remainders. Three general relationships which hold for primary photochemical changes are deduced from the author's hypothesis. H. M. D.

Theory of Absorption in Gases. Léon Bloch (*Compt. rend.*, 1908, **147**, 1284—1286).—According to Drude's theory of dispersion, the motion of the electrons is affected by friction, and the coefficient of friction, r, is assumed to be constant (independent of the wave-length). The author shows that, in the case of absorption in gases, r is a function of the wave-length. Employing the kinetic theory of gases, the formula obtained leads to the conclusion that r varies aproximately as the square root of the absolute temperature, a deduction in agreement with recent work by J. Becquerel. G. S.

Rotatory Power at Low Temperatures and the Relation between the Absorption of Light and Rotatory Polarisation in Crystals of Cinnabar. Jean Becquerel (*Compt. rend.*, 1908, **147**, 1281—1284).—Cotton (*Thèse,* 1896) has shown that there is a connexion between absorption of light and rotatory power in solution, and the author now shows by experiments with well-formed crystals of cinnabar that there is a similar relationship in active crystals.

The curve of rotatory dispersion at 18° and −188°, and the flutings in the spectrum at the same temperatures, are shown side by side on the same figure. The rotatory power increases rapidly near the absorbed region. On cooling to −188°, the yellow and a part of the red appear, and the great rotation appears no more in the orange, but is thrown back into the green, from which it is evident that the great rotatory dispersion is connected with the absorption.

Cinnabar posseses considerable magnetic rotatory power, and this property is being further investigated. G. S.

Magnetic Rotatory Power of the Vapour of Calcium Fluoride and of Nitrous Oxide in the Neighbourhood of their Absorption Bands. A. Dufour (*Compt. rend.*, 1908, **147**, 1471—1472).—In the case of calcium fluoride, the three bands $\lambda = 6037$, $\lambda = 6050{\cdot}8$, and $\lambda = 6064{\cdot}5$ were examined. The last shows the normal Zeeman effect, the other two the inverse phenomenon.

The nitrous oxide absorption bands $\lambda = 5854{\cdot}9$ and $\lambda = 5846{\cdot}8$ show the ordinary, whilst $\lambda = 5925{\cdot}4$ and $\lambda = 5856{\cdot}9$ exhibit the inverse, effect. H. M. D.

Nitroquinol Dimethyl Ether and Theory of Solution. Hugo Kauffmann (*Ber.*, 1908, **41**, 4396—4412).—Yellow nitroquinol dimethyl ether yields coloured solutions in dissociating solvents, and practically colourless solutions in non-dissociating solvents (Abstr., 1907, i, 127). Hantzsch claims (Abstr., 1908, ii, 447) that the ordinary yellow preparation cannot be the true nitroquinol dimethyl ether; the latter is colourless, and existent in solutions in feebly dissociating or non-dissociating solvents. His claim is based on the assumptions that all true nitro-compounds are colourless, and that the molecular refraction of nitroquinol dimethyl ether in feebly dissociating solvents is only slightly greater than the calculated value, whilst in solutions in strongly dissociating solvents a pronounced exaltation of the molecular refraction is observed. The author points out that Hantzsch contradicts himself, since he states (Abstr., 1907, i, 513) that nitrobenzene shows absorption in the extreme violet, which is only another way of saying that nitrobenzene is not colourless. With regard to the second point, it is known that substances containing auxochromes in the benzene nucleus exhibit abnormally high molecular refractions. Therefore the true nitroquinol dimethyl ether must be that form existent in solutions in strongly dissociating solvents, that is to say, the yellow modification.

The author, however, rejects the theory of the existence of several modifications of nitroquinol dimethyl ether, and accounts for the varying colour of its solutions in different solvents by a novel conception. The outlines of the theory are as follows. Since the change of colour of a fluorescent substance in different solvents occurs, in general, without change of constitution (Abstr., 1904, ii, 528), the conception of constitution alone is insufficient. A constitutively unchangeable substance must have some capacity of change within its molecule, so that the molecule, under different conditions, can assume different states. The graphic representation of such states, which necessitates the theory of the divisibility of valencies, is called the conditioning formula. The substance has, in general, a single unchangeable constitutional formula and several conditioning formulæ. The constitutional formula is an ideal state, to which the conditioning formulæ approximate more or less according to the conditions.

Furthermore, the author assumes that the divided valencies represent lines of force. A line of force starting from an atom of a molecule may terminate either in another atom of the same molecule or in a different molecule, the latter case being important in the case of solutions. The molecules of a dissociating solvent have the power of attracting to themselves the lines of force issuing from the molecules of a solute. Non-dissociating solvents, on the contrary, tend to make the lines of force terminate in the molecule in which they originate. By this theory the author attempts to account for the change of the fluorescent colour of a substance in different solvents (Abstr., 1907, ii, 519). C. S.

Triboluminescence. Désiré Gernez (*Ann. Chim. Phys.*, 1908, [viii], 15, 516—556).—A résumé of work already published (compare Abstr., 1905, ii, 365, 430, 431; 1908, ii, 748) together with a claim for priority against Trautz (Abstr., 1905, ii, 494, 662). Contrary to Tschugaeff's generalisation (Abstr., 1905, ii, 132), *d*-, *l*-, and *r*-erythritol all exhibit triboluminescence (Bertrand, Abstr., 1900, i, 424; Maquenne, Abstr., 1902, i, 131). M. A. W.

Disintegrating Action of Light and Optical Sensitisation. JOHANNES STARK (*Physikal. Zeitsch.*, 1908, 9, 894—900).—The disintegrating effect which ultra-violet light has been found to exert on gold-leaf exposed to its action is shown to be in accordance with theoretical requirements. An experiment is described which appears to show that positively charged atoms are emitted in consequence of the absorption of ultra-violet light. The action of sensitisers in promoting certain chemical changes is discussed in terms of the author's theory. H. M. D.

Concerning the [Luminiferous] Ether. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1468—1471).—The author discusses the ether in relation to the atomic and electron theories. T. H. P.

Action of Radium- and Röntgen-rays on the Colours of Precious Stones. CORNELIO DOELTER (*Monatsh.*, 1908, 29, 1145—1170).—A large number of observations are recorded relating to the changes in colour of precious stones and coloured glasses on exposure for different lengths of time to the action of radium- and Röntgen-rays. The colour changes are expressed in terms of the Radde scale. The two kinds of rays appear to act similarly on the coloured minerals. On account of the shorter periods of exposure in the case of the Röntgen-rays, a comparison of the activity of the two types of radiation is not possible. In certain cases the colour changes produced by the action of radium are reversed when the stones are heated to about 300° in oxygen or nitrogen.

The nature of the colouring substances is discussed. Amethyst, smoky quartz, rose quartz, and citrine are said to contain traces of iron thiocyanate, yellow diamonds, traces of iron and, possibly, cerium, ruby, traces of chromium and, possibly, iron. Chromium is also probably present as the chief colouring agent in yellow and green corundum and in certain sapphires. H. M. D.

Decay of Radium Emanation when Dissolved in Water. JOSÉ MUÑOZ DEL CASTILLO (*Anal. Fis. Quim.*, 1908, 6, 488—489).—A claim for priority (compare Moore, Abstr., 1908, ii, 651). W. A. D.

Radioactivity of the Atmosphere on Mountains. ALBERT GOCKEL and TH. WULF (*Physikal. Zeitsch.*, 1908, 9, 907—911).—Measurements have been made of the induced activity collected on wires suspended for periods of twenty-four to one hundred hours at various points in the neighbourhood of the Matterhorn. The decay curves indicate that, at a height of about 3000 metres, the amount of induced thorium activity is relatively small, varying from 0·5% to 10%. The activity of collected rain-water was found to be of the same order of magnitude as that collected in Freiburg (Switzerland) at a height of 650 metres.

With a special type of electrometer, the ionisation due to very penetrating rays was examined. No influence of elevation on such ionisation could be detected, and the authors surmise that this penetrating type of radiation emanates from the earth's surface.

H. M. D.

Radioactivity of Italian Gaseous Emanations. Raffaelo Nasini and Mario G. Levi (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 551—553).—The authors have measured the radioactivities of a number of gases of various Italian origins, of which they also give certain analytical data. The greatest radioactivity was exhibited by the gas, composed partly of hydrogen sulphide, from the thermal springs of Abano (Padua).

T. H. P.

Ionisation Phenomena caused by Rain-water. G. Costanzo and C. Negro (*Jahrb. Radioaktiv. Elektronik*, 1908, 5, 395—402. Compare Abstr., 1908, ii, 551).—The activity of fresh rain-water, collected during March and April, 1908, was examined by bubbling air through it, and leading the gas into the ionisation chamber of an electroscope. In some cases the rate of discharge was greater when the electroscope was positively charged, in others when the charge was negative. If the rain-water is perfectly fresh, and especially if its fall is accompanied by atmospheric disturbances of an electrical nature, the negative ions are in excess.

H. M. D.

Radioactivity of Waters from Alange. José Muñoz del Castillo (*Anal. Fis. Quim.*, 1908, 6, 489).—The waters of Alange, which have great value in the treatment of nervous diseases, have a radioactivity of 1495·9 volts per hour litre.

W. A. D.

Radioactivity of Certain Springs in Upper Austria. Max Bamberger (*Monatsh.*, 1908, 29, 1131—1140).—The radioactivity of spring-water emanating from the South Bohemian granite region in the neighbourhood of Schloss Tannbach has been found to be very high, 47—52 Mache units. The rate of decay of the induced activity indicates that the activity is due to disintegration products of radium.

H. M. D.

Radioactivity of Roumanian Mineral Waters. Dragomir Hurmuzescu and N. Patriciu (*Ann. Sci. Univ. Jassy*, 1908, 5, 159—165).—From measurements of the ionising power of the emanation obtained from various mineral waters, the authors have compared their radioactivities. These are of the same order of magnitude as the Swiss waters examined by Sury, Sarasin, Guye, and Micheli if the highly radioactive waters of Dissentis and Lavey-les-Bains are excepted.

H. M. D.

Radioactivity of Certain Spring-waters of the Semmering Province. Max Bamberger (*Monatsh.*, 1908, 29, 1141—1144).—Numbers representing the radioactivity of spring-waters are recorded. The springs emanating from quartz-phyllite are the most radioactive, whilst those from limestone exhibit the property very feebly.

H. M. D.

Specific Radioactivity of Thorium and its Products. GEORGE C. ASHMAN (*Amer. J. Sci.*, 1909, 27, 65—72).—The specific activity of thorium has been deduced from experimental measurements of the activity of new and old thorium (1) freed from the easily separated products thorium-*X*, emanation, thorium-*A*, -*B*, and -*C*, (2) after a period sufficiently long for the disintegration products to have accumulated in the equilibrium quantities.

In order to separate thorium and radio-thorium from the other disintegration products, the authors have made use of *m*-nitrobenzoic acid. After four precipitations of the thorium at 80° and at intervals of two hours, the disintegration products are completely removed; the precipitated thorium *m*-nitrobenzoate is then heated over a Bunsen flame, and finally for ten minutes over the blow-pipe.

From the measurements specified above, the author finds that the specific activity of thorium is 119. This represents 11% of the total activity of the thorium when the equilibrium condition has been reached.

Of the remaining activity, 20% is due to radio-thorium, and 69% to thorium-*X* and its subsequent products. H. M. D.

Heat Development due to Radioactivity of Thorium Oxide. G. B. PEGRAM and H. WEBB (*Chem. Zentr.*, 1908, ii, 1851; from *Le Radium*, 1908, 5, 271—276).—By means of a thermo-couple the temperature difference has been measured between 4 kilos. of thorium oxide in a Dewar vessel supported in a partly evacuated metal cylinder which was surounded with ice, and the ice jacket. A similar measurement was made when the thorium oxide was heated by passing a known current of electricity through a wire embedded in the mass. From these results, it is found that the liberation of heat per second per gram is equal to $1\cdot11\times10^{-8}$ watts, or $9\cdot60\times10^{-6}$ gram-calories per hour per gram. J. V. E.

Gaseous Ionisation and Pressure. T. H. LABY and G. W. C. KAYE (*Phil. Mag.*, 1908, [vi], 16, 879—889).—The authors have measured the ionisation produced by γ-rays of radium in air, hydrogen, and carbon dioxide at pressures from one to seventeen atmospheres. The γ-rays passed through 7 mm. of aluminium and 10 mm. of brass into a flat chamber containing an electrode and filled with the gas under investigation. The ionisation directly induced by the γ-rays is supposed to be small in amount and proportional to the pressure of the gas. The main effect is that of secondary β-rays from the aluminium electrode; this also varies as the pressure. Secondary β-rays excited in the gas, which would produce an ionisation proportional to the square of pressure, are not in evidence.

The amount of ionisation produced in the case of hydrogen was approximately proportional to the pressure. In air and carbon dioxide, the ionisation increased less rapidly than the pressure, particularly at high pressures. This phenomenon is attributable to a soft tertiary radiation produced in these gases by secondary β-rays. This would give a relatively larger effect at low pressures, since at higher pressures the gas would be more opaque to it and the range of the particles would be smaller. R. J. C.

Experimental Investigation of the Nature of γ-Rays. William H. Bragg and John P. V. Madsen (*Phil. Mag.*, 1908, [vi], 16, 918—939).—The authors adduce further experimental evidence in favour of the theory that γ-rays are material, and consist of β-particles combined with a positive charge (Abstr., 1908, ii, 556).

The γ-rays from radium were purified as well as possible from β-rays by passing through a magnetic field and then allowed to impinge on plates of various elements. Measurements were made of ionisation on both sides of the plates, that is, of reflected secondary β-radiation and of emergent secondary β-radiation. The reflected secondary β-radiation depends very largely on the atomic weight of the material of the plate employed, but the emergent β-radiation, which is almost always greater, is of the same order for all the elements. The production of β-rays by hard γ-rays appears to follow a density law independent of atomic weights, but softer γ-rays are affected by atomic considerations in that heavier atoms are the more absorbent and produce more secondary β-radiation.

The speed and penetrating power of secondary β-radiation are governed by the corresponding properties of the primary γ-radiation. The γ-rays of radium produce secondary β-rays which closely resemble the primary β-rays of radium in speed.

It is argued that the energy of the secondary β-ray does not come from disintegrated atoms, but from the exciting primary γ-ray. The authors' theory, although it requires the existence of positive electrons, is held to be simpler and more complete than that advocated by J. J. Thomson. The theory is also applicable to X-rays. R. J. C.

Law of the Optimum of Cathodic Phosphorescence in Binary Systems. Georges Urbain (*Compt. rend.*, 1908, **147**, 1472—1474).—The discovery of the general relationship in question is not due to the author, but to Lecoq de Boisbaudran. If instead of referring to the entire phosphorescent spectrum, the component parts are taken into consideration, it is possible to give the law of the optimum a more precise form. According to this, if the relative proportions of the active substance and the diluent are varied, each phosphorescent band passes through a maximum. Although the maxima for different bands do not necessarily correspond with the same composition of the binary system, the proportion of the active component is always very small. H. M. D

Minimum Quantity of Electricity. N. L. Müller (*Jahrb. Radioaktiv. Elektronik.*, 1908, 5, 402—408).—An explanation is given of the fact that the mass of the α-particle according to electromagnetic measurements is only 2, whereas if the α-particle be a helium atom it should be 4. If N is the number of ions in a gram, equivalent then $2 \times 96540/N$ is the quantity of electricity necessary for the separation of a molecule of hydrogen by electrolysis. This is supposed to be taken up by the hydrogen ions at the negative pole. Denoting the quantity by ϵ, the process of formation of a hydrogen molecule is represented by the equation $2H^{\cdot} + \epsilon = H_2\epsilon$. Other molecules can be similarly formulated, and in the case of helium, the formula of the atom is Heϵ, whereas that of the α-particle is He, and its mass is equal to 2. The direct measurements of ionic charges are discussed in terms of the author's hypothesis. H. M. D.

Variation in the Electrical Conductivity at Constant Temperature of Mineral Waters Containing Radium. José Muñoz de Castillo and Faustino Diaz de Rada (*Anal. Fis. Quim.*, 1908, 6, 485—488).—Measurements are given of the electrical conductivity and radioactivity of a number of natural Spanish mineral waters. The authors are collecting data which will enable them to discuss the relationship existing between the changes of conductivity and radioactivity of natural waters. W. A. D.

Relation of the Charge to the Mass of the Electron. Comparison of the Values Deduced from the Zeeman Effect and from Recent Measurements with Cathode Rays. A. Cotton and P. Weiss (*Compt. rend.*, 1908, **147**, 968—970).—From measurements of the distance between the side components of certain lines in the spectrum of zinc which become triplets in the magnetic field, the value $2 \times 1{\cdot}767 \times 10^{-7}$ is obtained for e/m (e = electric charge, m = mass of electron) on the basis of the theory of Lorentz; a result practically double that obtained for the same ratio from measurements with slow cathode rays. From similar measurements on the helium spectrum, however, Lohmann (Abstr., 1908, ii, 243) obtains $e/m = 1{\cdot}77 \times 10^{-7}$, a value in good agreement with that obtained from observations on cathode rays. G. S.

Electrical Resistance of the Alkali Metals, Gallium and Tellurium. Antoine Guntz and Witold Broniewski (*Compt. rend.*, 1908, **147**, 1474—1477).—The metals were introduced into capillary U-tubes, the resistances being compared directly with that of mercury. Sodium, potassium, rubidium, and cæsium were obtained from the chlorides by the action of calcium, and lithium by decomposition of the hydride. The specific resistances of these metals are recorded for a series of temperatures between −187° and the melting points of the metals. At 0° the values are cæsium 19·30, rubidium 12·80, potassium 7·01, sodium 4·30, lithium 8·55.

Corresponding with the contraction which takes place on fusion, the specific resistance of gallium is greater in the solid than in the supercooled liquid condition. For the solid, the value at 0° is 53·4.

The specific resistance of tellurium at 0° is 0·102; it increases with the temperature, attains a maximum at about 50°, and then diminishes until the melting point is reached. H. M. D.

E.M.F. of the Cadmium Normal Element at 0°. I. Ernst Cohen and Hugo R. Kruyt (*Zeitsch. physikal. Chem.*, 1909, **65**, 359—370).—Jouaust (*Compt. rend.*, 1908, **147**, 42) has stated that whilst the behaviour of cadmium elements made up with an amalgam containing 12·5% of cadmium by weight is regular down to 0°, the

E.M.F. of different cells containing a 10% cadmium amalgam shows deviations of several ten-thousandths, and these cells show certain other irregularities. The authors now show that there is a small, but probably real difference (since it is always in the same direction), not exceeding 0·2 millivolt, between cells made up with 10% and 12½% amalgams respectively, and consider that this small difference is due mainly to the difference in the concentration of the amalgams in the two cells, in accordance with the equilibrium relations discussed by Byl (Abstr., 1901, ii, 507). The differences, however, are not much greater than those observed with "identical" cells made up with the same amalgam, which may also amount to 0·2 millivolt. The statement of Jouaust (*loc. cit.*), that at 0° the use of a 12·5% amalgam is to be preferred, is therefore inaccurate.

Certain other of Jouaust's statements are criticised, but it is admitted that a further investigation of the electromotive behaviour of cadmium amalgams between 0° and 20° is desirable.

G. S.

Electrolytic Processes at the Surface of Electrodes. Hans G. Möller (*Zeitsch. physikal. Chem.*, 1908, 65, 226—254).—According to Nernst, the phenomenon of supertension ("überspannung") is connected with the capacity of the electrode material to occlude gases. The author considers that the power of occluding gases is connected with the molecular forces between electrode and gas, and hence with surface tension phenomena. These theoretical deductions have been confirmed experimentally; it is shown that there is parallelism between the supertension and the surface tension between gas and electrolyte, and also between the supertension and the angle at the junction of gas and electrode.

The supertension at different electrodes has been determined by constructing curves representing the variation of strength of current with *E.M.F.*, and the precautions required to obtain accurate results are fully described. The angle, θ, between gas and electrode was read off directly by means of a microscope capable of turning on its axis, and a special method for obtaining conditions suitable for measurement is described. The relationship between supertension and the two capillarity factors mentioned above has been proved by experiments with mercury at temperatures between 0° and 10°, and also with other electrodes, the surfaces of which were of different degrees of roughness and in some cases were covered with a thin layer of fat.

The relation between θ and the supertension, π, is represented with great accuracy by the equation $\pi = (e^{a\theta} - 1)/b$, which holds for all temperatures and all electrodes under any conditions of surface. For hydrogen and $N/10$ sulphuric acid, the constant $a = 0·0264$ and $b = 9$.

It has not hitherto been possible to determine the absolute value of the surface tension at the junction of solid metals, but the curve representing the variation of the angle, θ, as a function of the polarisation must be parabolic and have a maximum at the same point as the electro-capillary curve. It is shown experimentally that the maximum is the same for all the metals and electrolytes examined, provided the electrolyte contains metallic ions, but no complex ions, and that this value is at zero potential. If the metal is capable of forming complex salts, the maximum is displaced. The important result is thus established that the potential difference between electrode and electrolyte disappears when the surface tension at the electrode attains a maximum value; hence trustworthy results for absolute differences of potential are obtained by the use of the capillary electrometer. G. S.

[Oxide Theory of the Oxygen Electrode.] EMIL BOSE (*Zeitsch., Elektrochem.*, 1909, **15**, 11—12).—Polemical in reply to Lorenz (this vol., ii, 15). T. E.

Electromotive Behaviour of Mixtures of Uranyl and Uranous Salts. ROBERT LUTHER and ARTHUR C. MICHIE (*Zeitsch. Elektrochem.*, 1908, **14**, 826—829).—Uranous salts are strong reducing agents even in acid solutions; the oxidation by atmospheric oxygen is accelerated by iron salts, platinum black, and especially by copper salts. The difference of potential between a platinised platinum electrode and a solution of uranous and uranyl salts in sulphuric acid is given by $\epsilon = \epsilon_0 + RT/2F \log[UO_2^{\cdot\cdot}][H^{\cdot}]^4/[U^{\cdot\cdot\cdot\cdot}]$, where ϵ_0 is 0·419 volt more positive than the normal calomel electrode, or 0·696 volt more positive than the normal hydrogen electrode.

The *E.M.F.* of mercury-mercurous sulphate electrodes in 0·1*N* to 1·0*N*-sulphuric acid is very little affected by the strength of the acid. This is shown to be in quantitative agreement with Luther's views of the dissociation of sulphuric acid (Abstr., 1907, ii, 610). T. E.

Minimum of Conductivity in the Titration of Acids. ALFRED THIEL (*Zeitsch. Elektrochem.*, 1909, **15**, 1—4).—Bruni (Abstr., 1908, ii, 935, 1012) pointed out that the equation by means of which the author calculated the dissociation constants of weak acids from the position of the minimum conductivity of the partly-neutralised solutions (Abstr., 1908, i, 787) was based on incorrect assumptions. In the present paper, the author gives the correct equation for the case that the acid is titrated with 0·1*N* sodium hydroxide (the volume of the solution increasing). The assumptions made are the same as those made by Bruni, and the resulting equation becomes identical with his for the limiting case that the volume of the solution does not change during neutralisation. T. E.

Formation of Salts and Basicity of Acids. III. GIUSEPPE BRUNI and C. SANDONNINI (*Zeitsch. Elektrochem.*, 1908, **14**, 823—825. Compare Abstr., 1907, ii, 935, 1012).—The theoretical equation previously obtained indicates that when an acid, the conductivity of which is less than that of its neutral salt, is progressively neutralised, the conductivity must pass through a minimum which is displaced towards the salt end of the curve with increasing strength of acid and increasing dilution. The existence of this minimum is now proved for formic and acetic acids and *p*-nitrophenol. In all these cases it lies very close to the acid end of the curve. T. E.

Influence of Temperature on the Internal Energy and the Free Energy of Electrolytic Dissociation of Weak Acids and Bases. Harald Lundén (*J. Chim. phys.*, 1908, 6, 681—698).—The methods by which the heats of dissociation and of neutralisation may be calculated from the hydrolysis and dissociation constants are discussed. The relations between the heats of dissociation and neutralisation respectively and the absolute temperature T are best expressed by formulæ of the type $U=f(a, b, T)$, for example, $U=a+bT$ (U=internal energy; a and b are constants). The resulting formulæ are applied to calculate the changes of internal energy and of free energy obtainable in the electrolytic dissociation and neutralisation of a number of weak acids and bases. The temperature-coefficients of the internal energy, dU/dT, and of the free energy, dA/dT, and the inferior and superior limits of these coefficients have been obtained. From Nernst's theorem it is shown that dA/dT and dU/dT should have the same absolute value, but be of opposite sign, a deduction which is in moderate agreement with the facts. G. S.

Magnetic Properties of Simple Substances. P. Pascal (*Compt. rend.*, 1908, 147, 1290—1292. Compare Abstr., 1908, ii, 756, 927).—It is shown that, for diamagnetic substances of the same valency and of analogous chemical properties, the atomic susceptibility, χ (the product of specific susceptibility and atomic weight), is an exponential function of the atomic weight, a; hence the formula $\log_e\chi=\alpha+\beta a$ applies, where α and β are constants for the same group, but vary, especially β, with the valency. The validity of the law is shown by observations on the halogen, sulphur, and phosphorus groups. It holds independently of the temperature. G. S.

Magnetic Dichroism of Calcite and Dolomite admixed with Liquids. Georges Meslin (*Compt. rend.*, 1908, 147, 1277—1279).—Calcite and dolomite form, in association with a number of liquids, systems which show magnetic dichroism, but the sign of the effect is contrary throughout for the two substances. In both cases the change of sign takes place when the refractive index of the liquid exceeds 1·600; for calcite the change is from positive to negative at this point, and conversely for dolomite. G. S.

Magnetism of the Rare Earths. B. Urbain and Gustav Jantsch (*Compt. rend.*, 1908, 147, 1286—1288).—The magnetic susceptibility of the pure sesquioxides of a number of rare earths has been determined with the following results:

Element	Nd.	Sa.	Eu.	Gd.	Tb.	Dy.
Atomic weight ...	144·3	150·4	152·0	157·3	159·2	162·5
Magnetic power...	33·5	6·5	33·5	161·0	237·0	290·0

The relative numbers in the third line are referred to the value for cobalt sulphate heptahydrate = 39·7. The above and other results indicate that there is maximum of magnetic power in the cerium group, and a second in the yttrium group.

As the magnetic power differs so greatly for closely-allied elements, it may be used as a test for the composition of mixtures. G. S.

Measurement of Very Low Temperatures. XXII. The Thermo-element Gold–Silver at Liquid Hydrogen Temperatures. H. KAMERLINGH ONNES and J. CLAY (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, 11, 344—345).—The temperature-coefficient of the *E.M.F.* of the gold–silver thermo-element increases rapidly with falling temperature. The great sensitiveness of the element at the temperatures of liquid hydrogen renders it suitable for temperature measurements in this region. H. M. D.

New Model of the Calorimeter of N. A. Hesehus, and Determination by its means of the Specific Heat of Alloys of Tin and Bismuth. N. MARENIN [*J. Russ. Phys. Chem. Soc.*, 1908, 40, 393—398 ; (*Phys. Part*)].—This modification of Hesehus' calorimeter (*J. Phys.*, 1888, 489) allows of the weight of water in the calorimeter tube being determined by weighing this tube alone instead of the whole calorimeter. The author has measured for alloys of bismuth and tin containing from 0 to 100% of bismuth, (1) the temperatures of fusion ; (2) the specific heats, which increase continuously with the content of bismuth, and (3) the densities, which diminish continuously as the percentage of bismuth increases. T. H. P.

Specific Heat of Solid Substances. MAX THIESEN (*Ber. Deut. physikal. Ges.*, 1908, 6, 947—952. Compare Abstr., 1908, ii, 653, 808 ; Grüneisen, Abstr., 1908, ii, 653).—A consideration of specific heat data for elements in the solid condition leads the author to conclude that the coefficient of expansion and the specific heat vary with the temperature quite differently. With rise of temperature, the coefficient of expansion increases the more rapidly. Although the formula given by the author can be used to calculate specific heat values for a wide range of temperatures, the empirical relationship pointed out by Grüneisen is incorrect.

The remainder of the paper is devoted to a consideration of Einstein's theory of the solid state of aggregation as furnishing a satisfactory basis for a theory of the specific heat of solids. H. M. D.

Plait Point Temperatures of the System Water–Phenol. A. KEESING (*Proc. K. Acad. Wetensch. Amsterdam*, 1908, 11, 394—397).—Measurements of critical temperatures for mixtures of water and phenol have been made by heating quartz tubes containing mixtures of known composition in the vapour of pure benzidine in contact with an atmosphere of nitrogen. A minimum critical temperature (357°) was found corresponding with 10% of phenol. The temperatures for pure water and phenol respectively are 364·7° and 419·2°. The curve connecting the critical temperatures for mixtures between 10 and 100% of phenol exhibits a point of inflexion. H. M. D.

Variation of Trouton's Constant in a given Homologous System. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1493—1501).—The author has collected or calculated the values of Trouton's constant for members of the following series : (1) elements ; (2) inorganic compounds ; (3) saturated hydrocarbons ; (4) poly-methylene compounds; (5) homologues of benzene; (6) ethers, and (7) esters.

The values for series (3), (4), and (5) show that the value of the constant diminishes as the molecular weight and boiling point rise. In the first two of these series, the constant exhibits a maximum value at b. p. 100—125°. With the ethers, too, the constant diminishes rapidly as the molecular weight increases. T. H. P.

Melting Points. P. B. Dallimore (*Pharm. J.*, 1908, [iv], **27**, 802).—A form of apparatus is described by means of which the m. p.'s of fatty acids, waxes, and similar substances can be readily determined. It consists of a glass U-tube, one arm of which is longer than the other and open at the top. The upper end of the shorter arm is bent at right angles, and drawn out to a fine point having a small aperture at the end. The tube is completely filled with the melted substance, and, when cold, is attached to a thermometer and heated in the usual way, the open end of the longer arm being slightly above the level of the liquid in the bath. As soon as the m. p. is reached, a drop of liquid is forced out of the aperture by the weight of the liquid in the longer arm. E. G.

Hydrogen Polysulphides and Cryoscopy. Ezio Paternò (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 627—633).—In criticising the conclusions drawn by Bruni and Borgo (Abstr., 1908, ii, 102) concerning the formulæ of hydrogen polysulphides, the author points out that the cryoscopic constant of bromoform is variable and that no values obtained for the molecular weight of sulphur correspond exactly with the molecule S_8 (compare Orloff, *J. Russ. Phys. Chem. Soc.*, 1903, **35**, 642). The calculation made by Bruni and Borgo of the apparent molecular weight when one of the molecules H_2S_5, H_2S_6, and H_2S_7, or a mixture of them, exists in solution is faulty, since the same results are obtained in all cases where the relation between the numbers of hydrogen and sulphur atoms is constant, the total number of molecules also remaining unchanged. The uncertainty of the results obtained by these authors is confirmed by the work of Tanatar, Choina, and Koziroff (Abstr., 1895, ii, 41), who found that the depressions of the freezing point of water caused by organic non-electrolytes are not altered sensibly by adding to the water 10 or 20% of methyl or ethyl alcohol, whilst with salts the addition of alcohol increases the depressions obtained in water alone.

The author has measured the freezing-point depressions of bromoform produced by varying quantities and proportions of sulphur and carbon disulphide. The mean difference between the experimental results and the calculated ones is 6·8%.

Further, Bloch and Höhn (Abstr., 1908, ii, 579, 580) and Schenck and Falcke (Abstr., 1908, ii, 762) have shown that crude hydrogen polysulphide is not a mixture of H_2S_5, H_2S_6, H_2S_7, and H_2S_9, but that it contains the two sulphides H_2S_2 and H_2S_3.

The melting-point curves of mixtures of selenium and iodine obtained by Pellini and Pedrina (Abstr., 1908, ii, 833) do not show that these elements do not form a compound, but only that such compound decomposes before the eutectic temperature is reached.

Olivari's conclusions (this vol., ii, 37, 39) are also criticised.

T. H. P.

Law of Corresponding Boiling Points. ULRICH DÜHRING (*Zeitsch. physikal. Chem.*, 1909, 65, 338—340).—A claim for priority with reference to the discovery of the law in question, recently ascribed by Johnston (Abstr., 1908, ii, 358) to Ramsay and Young.

G. S.

Relation between the Capillary Constants and the Latent Heat of Vaporisation of the Solvent. PAUL WALDEN (*Zeitsch. physikal. Chem.*, 1909, 65, 257—288. Compare this vol., ii, 122).—It is shown from the available data for over sixty liquids that there is a simple relationship between the heat of vaporisation, λ, and the specific cohesion, a^2 ($a^2=rh$, where h is the height to which the liquid rises in a capillary tube of radius r mm.), both determined at the boiling point; for non-associated liquids, $\lambda/a^2=17\cdot9$; for associated liquids, λ/a^2 is greater than 17·9. Conversely, the heat of vaporisation can be calculated from the above relationship when the specific cohesion at the boiling point is known, and a more complex formula is deduced, by which the value of λ at the boiling point can be calculated from the value of a^2 at lower temperatures.

When liquids with very divergent boiling points are compared, the relationship beween a^2 and λ is represented more satisfactorily by means of the formula $\lambda/a^2=46\cdot0/\log T_\sigma$, where T_σ is the boiling point of the liquid on the absolute scale. By combining the last formula with Van't Hoff's formula for the molecular elevation, E, of the boiling point, $E=0\cdot02T^2/W$, the relationship between specific cohesion at the boiling point and boiling-point constant is obtained in the form $E=0\cdot00043T_\sigma^2\log T_\sigma/a^2$, a formula which permits of the calculation of E with considerable accuracy.

It is further shown that the molecular cohesion, Ma^2, the molecular heat of vaporisation, $M\lambda$, and the boiling point on the absolute scale are additive in character. For compounds containing only hydrogen, oxygen (bivalent), nitrogen (tervalent), and carbon, the formula $Ma^2=11\cdot5\Sigma n$, where Σn represents the sum of the valencies, holds within very wide limits. The formula is not valid for compounds containing the halogens on any of the usual assumptions as to their valency, nor does it hold for water, ammonia or methyl alcohol. The further relations $T\sigma=11\cdot2\Sigma n$ and $M\lambda=240\Sigma n$ are also shown to hold in many cases.

Finally, from the formula $\lambda/a^2=$ constant, the conclusion is drawn that the molecules of all non-associated liquids are approximately of the same diameter at their respective boiling points. G. S.

Latent Heat of Evaporation of *iso*Amyl Ether. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1471—1474).—The mean specific heat of *iso*amyl ether between 24° and 170° is 0·5721 ± 0·5%, the latent heat of evaporation, ρ, being 53·1 cals. with an accuracy of about 1% and Trouton's constant, K, 18·8. T. H. P.

Latent Heat of Evaporation and Specific Heat of Naphthalene. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1474—1477).—Taking the specific heat of naphthalene as 0·32 at 20° and 0·7 at 215°, the latent heat of evaporation is found to be 74·7 cals. and Trouton's constant, 19·3. The latter figure confirms the observation that, in an homologous series, Trouton's constant diminishes as the boiling point exceeds 100°. T. H. P.

Latent Heat of Vaporisation of Benzoin *iso*Butyl Ether. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1477—1480). —The latent heat of vaporisation of benzoin *iso*butyl ether is found to have the mean value 55·7 cals., the greatest deviation from this mean being 1·2%. From this value, Trouton's constant is calculated to be 19·3. The only substance having a high boiling point and a high Trouton constant (21·5) is mercury, which is not comparable with other substances, owing to the extreme simplicity of its molecular structure. T. H. P.

Latent Heat of Vaporisation of Acetic Anhydride and Determination of the Association of Liquids. W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1480—1487).—The author shows that the value of the Ramsay-Shields constant for determining whether a liquid is associated is greatly diminished by the observations (1) that the magnitude of the constant changes with the molecular weight, and that (2) change of the constant with rise of temperature occurs even with non-associated compounds.

The author's measurements of the specific heat of acetic anhydride lead to the mean value 0·4551 ± 0·33% for the range of temperature 20—138°. The latent heat of vaporisation is found to be 92·6 ± 0·5% at 138°. Trouton's constant, calculated from these results, is 22·9. Acetic anhydride is hence associated, and is converted into simple molecules at the moment of boiling. T. H. P.

Lithium, Strontium, and Barium Oxides. ROBERT DE FORCRAND (*Ann. Chim. Phys.*, 1908, [viii], 15, 433—490).—A detailed account of work already published (compare Abstr., 1907, ii, 615, 683, 928; 1908, ii, 155, 493, 764). Using the corrected value for the heat of solution of strontium oxide (Abstr., 1908, ii, 765), the heat of formation of strontium oxide is 138·64 Cal., and not 137·6 Cal. as stated (Abstr., 1908, ii, 155). The heats of formation of the peroxides of calcium, strontium, and barium are 157·37, 153·07, and 145·58 Cal. respectively, and not 157·33, 152·10, and 145·71 Cal. as stated (*loc. cit.*). M. A. W.

Heat of Hydration. WILLEM P. JORISSEN (*Chem. Weekblad*, 1908, 5, 875—888).—A summary of the literature on heat of hydration, and a criticism of the results obtained. A. J. W.

Heats of Dissociation of some Electrolytes in Organic Solvents. PAUL DUTOIT and H. DUPERTHUIS (*J. Chim. Phys.*, 1908, 6, 699—725).—The electrical conductivity, and hence the degree of ionisation, of sodium iodide in ethyl, propyl, *iso*butyl, and *iso*amyl alcohols, and in acetone and pyridine, has been determined at intervals of 10° between 0° and 80° (in the case of acetone up to 40°), and similar measurements have been made with potassium iodide and sodium and potassium thiocyanates in pyridine. The dilutions employed were from 1000 to 20,000 litres per mol. of salt, within which limits Ostwald's dilution law applies in most cases, so that the degree of dissociation can be accurately determined. From the results, the heat of dissociation has been calculated by Van't Hoff's formula.

Contrary to Walden's statement (Abstr., 1907, ii, 437), the heat of dissociation of a salt has not the same value in different solvents; for sodium iodide as solute it is positive in ethyl alcohol, zero in acetone, and negative in the other alcohols and in pyridine. Further, the heat of ionisation also varies greatly with the temperature in most cases; in *iso*amyl alcohol it is −2008 cal. at 15° and −16,760 cal. at 75°. On the other hand, the heats of ionisation in pyridine of the four salts above mentioned are nearly equal and do not vary much with temperature.

The fact that for what is presumably the same reaction, $NaI = Na^{\cdot} + I'$, the thermal effect in different solvents is very different, indicates that the process in question is not simple; it is probable that combination between ions and solvent is of importance. The differences between the authors' results and those of Walden are ascribed to the fact that the latter observer used erroneous values for the molecular conductivity at infinite dilution, obtained by extrapolation from relatively concentrated solutions. G. S.

The Density of Liquids Below Zero. JEAN TIMMERMANS (*Bull. Soc. chim. Belg.*, 1908, 22, 427—439).—It has been shown previously (Abstr., 1908, ii, 85) that none of the liquids studied has a maximum density analogous to that of water at 4°. The original experiments, which were accurate to the extent of 1 in 1000, have now been repeated more exactly, the error not exceeding 1 in 10,000. The present paper relates to the apparatus and experimental methods employed. The measurements were made by means of the dilatometer. A series of the latter were employed in order to avoid capillary tubes of unwieldy length to cover the range of temperature considered, and were calibrated with an accuracy of 1 in 20,000. The apparent internal volume of the dilatometers at 0° was not altered by two hours' immersion in liquid air. The errors due to the meniscus were corrected in the case of mercury as calculated by Schalkwyk and by Göckel, and in the case of liquids which "wet" glass by assuming the surface of the liquid in the capillary to be hemispherical. This correction amounts to about 1/10,000th of the volume to be measured. With very volatile liquids a correction, amounting to about 1/10,000th of the total weight, had to be made for the weight of saturated vapour in the dilatometer above the surface of the liquid. The densities of the liquids at 0° compared with that of water at 4° were taken as standards, and were determined by means of an Ostwald-Perkin pyknometer. The apparatus for maintaining the dilatometer at constant and uniform temperatures below 0° consists of a tube to contain a pure liquid (for cooling the dilatometer), solidifying at a known temperature below 0°, surrounded by a Dewar tube provided with a tubulure and stopcock, which again is surrounded by another Dewar vessel, the walls of the latter being silvered except over a small space left transparent for reading the volumes in the dilatometer. The outer vessel must be maintained (by means of liquid air or carbon dioxide) at least 15—20° below the solidification point of the cooling liquid. Air is kept between the walls of the inner Dewar vessel until the cooling liquid (which must be kept continually stirred) solidifies (this should occur rapidly throughout the entire liquid) when it is pumped out until the internal pressure is 50—200 mm., according to the difference of temperature of the inner tube and the outer Dewar vessel. This prevents further cooling of the cooling-bath, and enables the latter to be kept at a known constant and uniform temperature for some hours. Thus the volume of liquid in the dilatometer can be measured at fixed uniform temperatures below 0°. The temperatures are determined by a Callendar resistance thermometer in conjunction with a Callendar-Griffin bridge, by means of which resistances can be measured to 1/10,000th of an ohm. The exact evaluation of the temperature is made according to the calculations of Travers and Gwyer (Abstr., 1905, ii, 372).

The sole systematic errors of any importance in the work are (1) that in the calibration of the dilatometers, equal to 1/20,000th of the density, (2) that in reducing the scale of the platinum resistance thermometer to the scale of the gas thermometer, equal to 1/10,000th of the density.

The results obtained for ethyl acetate show that the density of this liquid varies according to the expresson $D_t = 0{\cdot}92540 - 0{\cdot}0011863t$, D_t being the density at $-t°$, t the temperature interval below 0°, and 0·92540 the density at 0°. The greatest difference between the observed densities and those calculated by this formula is only 0·00014.

E. H.

Expansion Coefficient, Specific Cohesion, Surface Tension, and Molecular Weight of Solvents. PAUL WALDEN (*Zeitsch. physikal. Chem.*, 1908, 65, 129—225).—The densities of a number of carefully purified liquids which have considerable solvent power have been determined at 0°, 25°, and 50°. From these results and the available experimental data on the density, specific cohesion, and surface tension of a large number of liquids, and the variation of these properties with the temperature, certain relationships are deduced between these properties themselves and between the physical properties and molecular weights of the solvents in question.

The general formula, $V_t = V_0/(1 - kt)$, proposed by Mendeléeff to represent the variation of the density of liquids with temperature, has been tested by application to the data for forty-nine different liquids, including some liquefied gases. It is valid for liquids boiling below 100°, but only moderately so for liquids boiling at higher temperatures; k varies for different liquids between 0·000178 and 0·00216.

For non-associated substances, the "expansion modulus," k, is inversely proportional to the critical temperature, t_c, on the centigrade scale, and in many cases $kt_c = 0{\cdot}34$. For certain liquefied gases and other liquids with low critical temperatures, the value of $kT'_c =$

constant = 0·49, the critical temperature being measured on the absolute scale. There is also parallelism, but not proportionality, between the expansion modulus and the compressibility of liquids.

The data as to the surface tension, γ, for over fifty liquids are taken from the results of Ramsay, Guye, and others; those for the "specific cohesion," a^2, are mostly calculated from the values of γ by means of the equation, $a^2 = 2\gamma/9{\cdot}81d$, where d is the density. In some cases the γ values are calculated from the experimental values of a^2 by means of the same formula. The variations of the surface tension and the specific cohesion respectively with the temperature are represented through a wide range of temperature by the equations $\gamma_t = \gamma_0(1 - \beta t)$ and $a_t^2 = a_0^2(1 - k_1 t)$, where β and k_1 are constants for any one liquid, but vary with the nature of the liquid. It is shown that for non-associated liquids, βt_c = constant = 1·16, and that $k_1 t_c$ = constant = 0·94. From these equations the critical temperature can be calculated when β or k_1 are known, and it is shown that the calculated and observed results are in good agreement. Other methods which have been suggested for calculating critical temperatures are discussed.

Further, the quotient of the latent heat of evaporation at the boiling point, λ_σ, by the specific cohesion at the same temperature is constant and = 17·9. Combining this with the mathematical expression for Trouton's rule, $M\lambda_\sigma/T_\sigma = 20{\cdot}7$, where M is the molecular weight of the liquid, the equation $Ma^2_\sigma/T_\sigma = 1{\cdot}16$ is obtained, and is shown to be valid for non-associated liquids (compare Kistiakowsky, Abstr., 1906, ii, 655). For associated liquids, this expression is no longer constant, but is smaller the more the liquid is associated. We have thus a new method for determining the molecular weight of liquids, which appears to give more consistent results than any other method so far suggested. In the first instance, the above equation only applies to observations at the boiling point, but a rather more complicated equation is derived which admits of the calculation of the molecular weight from capillary observations at any temperature.

When allowance is made for the fact that Trouton's rule is only valid over a limited range of temperature, a more accurate formula, $M = 0{\cdot}435 T_\sigma \log T_\sigma / a^2_\sigma$, is obtained, and is applied to the determination of the molecular weight of liquefied gases and other liquids. Of the ten liquefied gases considered, only hydrogen chloride is considerably associated (association factor = 1·32). The association factor for cadmium is rather less than unity; it is therefore monatomic in the liquid state.

When, instead of the specific cohesion, the surface tension, γ, is used, the expression $M\lambda/V\gamma_\sigma = 3{\cdot}64$ is obtained, where V is the molecular volume, and the other factors have the same significance as above. Combining this with Trouton's rule, we obtain $V\gamma_\sigma/T_\sigma = 5{\cdot}67$. These expressions are shown to be valid for a large number of non-associated liquids, but for associated liquids the quotients are less than 3·64 and 5·67 respectively, and from the observed values the degree of association can be calculated.

According to Eötvös-Ramsay-Shields, the temperature-coefficient of the "molecular surface energy" should be constant for non-associated liquids, that is, $d(\gamma V^{\frac{2}{3}})/dt = \text{constant} = 2\cdot12$. The above considerations, however, lead to the conclusion that $d(\gamma V)/dt$ should be constant, and it is shown by application to twenty-four typical liquids that the latter expression varies less than the former; the mean value is 8·80. For associated liquids the value is less, and from the above equation the degree of association can be calculated as in the case of the Eötvös equation. The results obtained by the two methods are in satisfactory agreement. G. S.

Liquefaction and Compressibility of Gaseous Mixtures. A Case in which Combination Occurs. E. Briner and E. Cardoso (*J. Chim. Phys.*, 1908, 6, 641—680).—The gases were liquefied by means of liquid air or solid carbon dioxide and ether, and purified by fractional distillation. The compression was effected with a Cailletet pump, the compression tube contained a stirrer worked by a magnet, and the pressure was measured on a nitrogen manometer.

The compressibilities and vapour tensions of certain binary mixtures, and of the components separately, have been determined at different temperatures.

A mixture of sulphur dioxide and methyl ether in equivalent proportions liquefies with very little alteration of pressure, and the vapour-pressure curve of the system shows a minimum at the same composition, from which the conclusion is drawn that a compound, SO_2,Me_2O, exists. The critical temperature of a mixture of this composition is 152·5°, between those of the components, and the critical pressure 62 atmospheres. From the variation of the pressure of the binary mixture with temperature, it is calculated by means of Van't Hoff's equation that the heat given out by the reaction $Me_2O(gas) + SO_2(gas) = Me_2O,SO_2(solid)$ is 11·8 cal. between 50° and 100° and 8·7 cal. between 138° and 147°.

No evidence of combination has been obtained in the following binary systems: methyl ether and methane, methyl ether and carbon dioxide, and methyl ether and nitric oxide. G. S.

Relation between Surface Tension and Specific Volume of Non-associated Liquids. Reginald O. Herzog (*Zeitsch. Elektrochem.*, 1908, 14, 830—831).—By combining Avenarius' equation for the dependence of specific volume on temperature with Van der Waals' equation for surface tension and temperature, the author obtains $\log\gamma + \mu v = r$, where γ and v are surface tension and specific volume at the same temperature, and μ and r specific constants of the substance. The relation is shown to hold good for six liquids. The relation $\mu = 5\cdot28$ times the critical density is also true. T. E.

Supertension and Viscosity. Charles Marie (*Compt. rend.*, 1908, 147, 1400—1402).—The effect of variations in the viscosity of the electrolyte on the excess voltage required to liberate hydrogen at different electrodes dipping in $N/1$-sulphuric acid has been examined When the supertension is small, the effect of increased viscosity is slight, thus 0·5% of gelatin raises the supertension at platinised platinum electrodes at most by 0·001 volt, but for metals with high supertension the effect is much greater, thus 0·1% of gelatin raises the supertension at lead electrodes by 0·05 volt. G. S.

Viscosities and Limiting Conductivities. PAUL DUTOIT and H. DUPERTHUIS (*J. Chim. Phys.*, 1908, 6, 726—731).—Walden (Abstr., 1906, ii, 335) has shown that for tetraethylammonium iodide in organic solvents the product of the viscosity, η, of the solvent and the molecular conductivity at infinite dilution, μ_∞, is independent of the nature of the solvent and of the temperature; $\eta\mu_\infty = 0·7$ approximately. The authors have determined the viscosities at intervals of 10° between 0° and 40° (in some cases up to 80°) of the seven solvents already mentioned (see this vol., ii, 120), and show that Walden's rule is not of general validity. The product $\eta\mu_\infty$ is not the same for the different solvents, nor does it tend towards a fixed value as the temperature rises. At 0° the extreme values are 0·374 (in *iso*amyl alcohol) and 0·573 (in pyridine), and at 80° the extreme values are 0·225 and 0·559 (in the same solvents). Further, $\eta\mu_\infty$ varies with the temperature; in four of the solvents it diminishes, and in one it increases, with increase of temperature. The variations are considerable in some solvents; from 80° to 0°, $\eta\mu_\infty$ increases by 47% in *iso*amyl alcohol and by 25% in *iso*butyl alcohol. G. S.

Adsorption. LEONOR MICHAELIS and PETER RONA (*Biochem. Zeitsch.*, 1908, 15, 196—216).—Determinations were made of the adsorption of acetone by charcoal, and the results were found to agree with the theory of Gibbs and Freundlich. The adsorbabilities of acetone in the presence of acetic acid, or acetic acid in the presence of acetone, by charcoal were also determined, and it was found that the simultaneous presence of two adsorbable substances diminished the adsorbability of either. The phenomenon of the diminution of adsorbability by the presence of a second adsorbable substance was not observed, however, in the case of proteins and certain dyes. In the case of the former substances, there is a further peculiarity, in that the adsorption process is not reversible. This was thought to be due to the conversion of the protein into an insoluble form, such as takes place on coagulation, but the same phenomenon takes place when albumoses are adsorbed, and it was experimentally shown that in this case the presence of acetone does not diminish its adsorbability by charcoal. The conclusion is drawn that the adsorption of proteins is not a simple mechanical process, but depends probably on the electrical properties of the surfaces. S. B. S.

Coefficient of Diffusion. BASIL W. CLACK (*Phil. Mag.*, 1908, [vi], 16, 863—879).—The author has endeavoured to elaborate an accurate method of measuring the diffusion coefficients of dissolved salts, and to determine to what extent diffusion depends on concentration.

The solutions under investigation were enclosed in a glass bulb into which a diffusion tube 4 cm. long was sealed in such a way that the end projected 2 cm. into the bulb. The bulb was suspended in distilled water beneath the pan of a delicate balance, so that the weight of its contents could be measured automatically from time to time. As salt diffused out of the bulb, the solutions contracted, and water entered to make up for this contraction at nearly constant rates so long as the concentration was not appreciably diminished. A steady distribution of concentration being established in the diffusion tube, an equation could be deduced connecting the rate of loss of weight of the bulb with the coefficient of diffusion.

The results obtained are held to show that the method is capable of yielding accurate values when certain conditions of experiment are observed. The following diffusion coefficients at 0° are given: KNO_3 in 10% solution 0·844, in 5% solution 0·870; KCl in 20% solution 0·972, in 10% solution 0·954. R. J. C.

Osmosis of the Alkali Haloids. FRANZ WIEMERS (*Ann. Physik*, 1908, [iv], 27, 1081—1098).—Measurements have been made of the relative changes in concentration which take place in solutions of the halogen salts of the alkali metals when the solutions are separated from water by a membrane of pig's bladder. The data are used to calculate the so-called endosmotic equivalent, the quantity of water which in a given time replaces unit quantity of the dissolved substance.

The endosmotic equivalent decreases as the molecular weight of the dissolved haloid salt increases. It is independent of the temperature, although the absolute magnitude of the two diffusion currents increases with rise of temperature in consequence of the greater velocity of the molecules. With increasing concentration of the solution, the diffusion currents increase in magnitude, but since the flow of water increases more rapidly than that of the salt solution, the endosmotic equivalent is greater the more concentrated the solution. H. M. D.

Osmotic Pressures of Aqueous Solutions of Calcium Ferrocyanide. I. Concentrated Solutions. EARL OF BERKELEY, ERNALD G. J. HARTLEY, and C. V. BURTON (*Phil. Trans.*, 1908, *A*, 209, 177—203).—Porter's equation taking account of the effect of compressibility of solvent and solution on the relation of osmotic to vapour pressures (Abstr., 1907, ii, 743; 1908, ii, 670), can be modified and applied to determinations of vapour pressure made in air at atmospheric pressure instead of under vacuum conditions. Whilst Porter's equation yields results differing from the authors' experiments by 2 or 3%, the modified equation is in close agreement with experiment. The authors have endeavoured to increase the accuracy of their vapour-pressure determinations in order to render the correction for compressibility significant.

Determinations were made at 0° of osmotic pressure, vapour pressure, and compressibility of concentrated solutions of calcium ferrocyanide. The purest salt, recrystallised to eliminate potassium, consisted of yellow crystals containing $11H_2O$.

In previous measurements of vapour pressure by the bubbling method, an unexplained loss of weight occurred in the whole apparatus as well as in the particular bulb containing the solution. The complete elimination of rubber tubing from the apparatus and the substitution of mercury seals, although an advantage, was not entirely satisfactory, because a ponderable amount of mercury now volatilised. Finally, platinum-iridium connecting tubes with ground-in junctions were used throughout, and no appreciable source of error was found in the method so modified.

Determinations of osmotic pressure were carried out as previously described (Abstr., 1906, ii, 599). The amount of calcium ferrocyanide leaking through the copper ferrocyanide membrane was found to be practically nil.

A special form of piezometer was employed for compressibility determinations. The compressibility tube was made of Jena glass, the compression coefficient of which has been determined by Straubel to be 228×10^{-8}. A check experiment made by the authors gave the value 223×10^{-8}. Possible sources of error, particularly those due to temperature, were carefully guarded against.

The concordance of observed osmotic equilibrium pressures, and those calculated from vapour pressures and compressibilities by the modified Porter's equation, is held to indicate a satisfactory agreement between experiment and thermodynamic reasoning. R. J. C.

Contact Pyrogenetic Oxidation of Hydrogen and Carbon Monoxide by Air. E. I. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1590—1595).—The author has studied the oxidation of excess of hydrogen and of carbon monoxide by air in presence of copper or platinum gauze under such conditions that the contact material is heated by the oxidation process. The results are given in detail, and do not admit of condensation (compare following abstract).

T. H. P.

General Conditions of Contact Oxidations accompanied by Auto-heating of the Contact Layer. E. I. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1596—1603. Compare preceding abstract).—These contact oxidations are divided into two classes: (I) reversible reactions, such as $2H_2 + O_2 \rightleftharpoons 2H_2O$, $2SO_2 + O_2 \rightleftharpoons 2SO_3$, and $4HCl + O_2 \rightleftharpoons 2H_2O + 2Cl_2$; (II) reactions which are not reversible under the experimental conditions, such as $2CO + O_2 = 2CO_2$ and $4NH_3 + 3O_2 = 2N_2 + 6H_2O$.

Class I.—In this case the velocity of flow of the mixed gases is without influence on the magnitude of $C^2.C_1/C_{11}^2$, which has the constant value 0·55, C and C_1 representing the initial concentrations of the hydrogen and oxygen respectively, and C_{11} the concentration of the water vapour. In contact with the heated layer of copper or platinum gauze, the gases occupy a volume V_m greater than the volume V they occupy after leaving this layer and cooling. If r is the ratio of the initial speed to the mean speed of the gases, and K and K_1 the concentrations of the hydrogen and oxygen respectively in the final gases, $(C^2.C_1/r^2)^{V_m} = (K^2K_1)^V$. Inserting the values of C^2C_1/r^2 and $K^2.K_1$ given by the four experiments previously described (see preceding abstract), the quotient V_m/V is found to be 6, 6·87, 5·87, and 6·8. If t° represents the fall of the temperature of the gases on leaving the heated contact layer, $V_m/V = 273/(273 - t)$, from which $t^\circ =$ 227°, 233°, 226°, and 230°; using a contact layer 8—12 cm. in length, the actual difference of temperature between the heated and unheated parts was found to be approximately 230°.

Class II.—In this case, not only the concentrations, but also the speed with which the mixed gases meet the contact layer is of importance, and unless the velocity of flow reaches a certain value in each particular case, no heating of the contact layer takes place. For the oxidation of carbon monoxide and methyl and propyl alcohols, the constant, C^2C_1/V^2, has the values 0·022—0·021, 0·00103, and 0·000103 respectively, C and C_1 being the initial volume concentrations of the carbon monoxide, etc., and of the oxygen respectively, and V the mean velocity of the gaseous mixture. From the equation $(C^2C_1/r^2)^x = (K^2K_1)^r$, it is calculated by means of the experimental numbers obtained (see preceding abstract) that $X/Y = 2·04$, 2·21, and 2·1. It is found experimentally that the ratio of the absolute temperature of the heated portion of the contact layer to that of the cool portion, T_1/T_2, has the approximate value 2, from which it is deduced that $T_1/T_2 = X/Y$. Replacing X and Y in the equation given above by T_1 and T_2 respectively, an expression is obtained showing that increase of r, decrease of V, and increase of T_1/T_2, all cause increase of the reaction between carbon monoxide and oxygen. With methyl and propyl alcohols, the primary oxidation is accompanied by decomposition of the alcohol and oxidation of the decomposition products, whilst with ammonia part of the nitrogen originally formed is oxidised to oxides of nitrogen. T. H. P.

Polyiodides. F. Olivari (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 584—590).—The author has studied the influence of the solvent on the relation $x/y = \theta$ between the concentration x in gram-mols. of iodine dissolved and the concentration of an insoluble iodide (KI) passing into solution to form polyiodides (KI_{2n+1}).

The results show that all the alcohols, acids, esters, ketones, cyano- and nitro-derivatives, on which iodine has no chemical action, allow of the formation of polyiodides. The solubility of potassium iodide in presence of iodine increases approximately with the dielectric constant of the solvent.

With solvents having analogous chemical functions, the ratio θ, and also x, increase, and consequently the absorption of potassium iodide diminishes with increase of the molecular weight of the solvent, that is, with increase of its anomalising power and with decrease of its dielectric constant.

Comparison of the results obtained with solvents having different chemical functions shows that the absorption of potassium iodide depends on the anomalising property as well as on the dissociating power of the solvent. The solvents which increase the ratio θ, do so in the following order: acetic acid (9·7), ethyl acetate (6·11), ethyl alcohol (25·8), nitrobenzene (36·4), ethyl bromide (9), hydrocarbons (2), the numbers in brackets representing the respective dielectric constants. As regards anomalising power, the series CO_2H, CO_2R, OH, NO_2, Br, Me is in very good agreement with the series given by Auwers (Abstr., 1903, ii, 268), considering that these groups are not united to the same radicle in the solvents investigated.

With different iodides and the same solvent, it is found that when the solutions of iodine are dilute, almost identical values of θ are given by the iodides of any one group of the periodic system. With concentrated solutions, however, deviations occur in a definite sense, which seems to indicate that they bear a relation to the electropositive character of the metal. Diminution of the latter character is accompanied by a diminution in the absorption of the iodide by a nitrobenzene solution of iodine. T. H. P.

Kinetics of Alkylation. Heinrich Goldschmidt (*Zeitsch Elektrochem.*, 1909, **15**, 10—11).—The experiments of Acree and his pupils (Abstr., 1908, ii, 919) do not prove the existence of tautomeric forms in solution, as they are equally well explained by the supposition that the alkyl halide is added on to the anion of the salt in two different ways, the two complex ions yielding the O- and N-ethers respectively. T. E.

Researches on the Formation of Esters. Heinrich Goldschmidt [with M. Asriel, V. Koren Lund, and Olaf Udby] (*Zeitsch. Elektrochem.*, 1909, **15**, 4—10).—Kailan (Abstr., 1908, ii, 936) finds that the rate of esterification of trichloroacetic acid without a catalyst is not in agreement with the theory of hydrogen ion catalysis. The author therefore gives a résumé of the unpublished results which he has obtained during the past few years. The rate of esterification of tri- and di-chloroacetic acids is increased slightly by the addition of a salt of the acid, that of formic acid is much diminished. With di- and tri-chloroacetic acids, the reaction is of the second order; with formic acid the second order constants rapidly diminish, but are constant in presence of a formate; the aromatic sulphinic acids give a reaction lying between the first and second orders. Probably in these cases the hydrogen ion catalysis is of secondary importance, some other reaction accounting for the main part of the ester formation.

The esterification of formic acid, using picric, trichloroacetic, trichlorobutyric, and dichloroacetic acids as catalysts, was studied in alcohol dried with calcium. The addition of the piperidine salt of the acid diminishes the rate of change, the effect being larger with the weaker acids. The catalytic action of hydrogen chloride is not affected by the addition of a chloride. The conductivity of the alcoholic solutions of the acids was also measured, and the catalytic action is found to be almost proportional to the conductivity of the solutions. The rates of esterification of formic acid by picric acid in different concentrations are also nearly proportional to the conductivities of the solutions. With weaker acids the agreement was not so good, possibly the non-dissociated complex of catalytic acid and alcohol reacts slowly with the acid to form the ester, the effect being superposed on that of the hydrogen ion. The addition of water to a solution of hydrogen chloride in absolute alcohol diminishes its conductivity to a minimum; for all other acids the conductivity increases steadily. It follows from the theory of hydrogen ion catalysis that the ratio of the catalytic accelerations produced by two acids must be independent of the nature of the acid undergoing esterification. The ratio of the rates of esterification of acetic acid in presence of hydrochloric and picric acids is 13·5; for propionic acid it is 13·1; for *n*-butyric acid, 13·1; for phenylacetic acid, 13·8; and for phenylpropionic acid, 13·0. The ratio of the accelerations of hydrochloric and sulphosalicylic acids is also found to be the same with five acids.

The formation of *iso*butyl and methyl esters in presence of hydrochloric acid is studied. The equation obtained by the author and Udby (Abstr., 1907, ii, 852) applies in these cases as well as in that of the ethyl esters. The rates of esterification of acetic and phenylacetic acids are determined at different temperatures, and the temperature-coefficients found to be the same. All these results are in good agreement with the theory of hydrogen ion catalysis developed by the author (Abstr., 1907, ii, 852). The self-esterification of an acid, however, appears to be mainly due to some other reaction. T. E.

History of the Discovery of the Rules of the so-called "Steric Hindrance." FRIEDRICH KEHRMANN (*Ber.*, 1908, **41**, 4357—4358).—A claim for priority in the statement of the phenomenon of steric hindrance. The author foreshadowed this in 1888 (Abstr., 1889, 243), and called attention (*inter alia*) to the difficulty of esterifying *o*-substituted carboxylic acids in 1890 (Abstr., 1890, 484), whilst V. Meyer's first paper on this subject was published in 1894 (Abstr., 1894, i, 243). J. C. C.

Physico-chemical Investigation of the Reactions between Egg-albumin and Acetic Acid. LUDWIK ZOJA (*Zeitsch. Chem. Ind. Kolloide*, 1908, **3**, 249—269).—On the addition of acetic acid to dialysed egg-albumin, the viscosity of the resulting solution increases with time, and under certain circumstances the end result is a solid jelly. The process of gelatinisation has been studied by measurements of viscosity, electrical conductivity, and density. The variation of the viscosity with time depends very much on the concentration of the acetic acid. Below 3·22 mols. per litre, the viscosity remains constant; with increasing acetic acid concentration the rate of alteration of the viscosity with time increases, attains a maximum at 7·01 mols. per litre, and then decreases as the acid concentration is further increased. On the other hand, the electrical conductivity does not change with time, and the curves which represent the dependence of the conductivity on the acetic acid concentration are closely similar to the corresponding curves for acetic acid-water mixtures. Both curves exhibit a maximum at about 3·2 mols. acid per litre.

The change of viscosity with time is supposed to be due to an action of hydrogen ions on the particles of the colloid. In agreement with this, it is found that the rate of gelatinisation is greater when the acetic acid is replaced by formic acid, and less when replaced by propionic acid.

Observations relating to the influence of calcium acetate indicate that the reaction is catalytically accelerated by calcium ions. The increase in viscosity takes place more rapidly at 25° than at higher or lower temperatures when the other conditions are maintained constant. H. M. D.

Hydration in Solution as the cause of certain Solubility Influences. C. S. Hudson (*Zeitsch. Elektrochem.*, 1908, 14, 821—823; *J. Amer. Chem. Soc.*, 1909, 31, 63—66).—The solubility of anhydrous sodium sulphate in water is diminished by the addition of carbamide, whilst that of Glauber's salt is increased. The author supposes that the solution contains molecules of the anhydrous salt and molecules of the hydrate; in presence of the solid anhydride, the concentration of the former is a, that of the latter is h. The total solubility of the anhydrous salt is therefore $s = a + h$. If p is the vapour pressure of the solution, $h/a = \text{const.}\ p^n$. The addition of a foreign substance to the solution diminishes p, and therefore diminishes h also, since a (in presence of the solid anhydrous salt) is constant. The solubility of the anhydrous salt is therefore diminished by the addition of a foreign substance to the solution. Precisely the same argument applied to the hydrated salt shows that its solubility must be increased. T. E.

Theory of Colloidal Solutions. Luigi Rolla (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 650—654).—The author has carried out a series of experiments on metallic colloids with the object of determining the charge of the granules and the relation between charge and mass, making use of Stokes's formula. The colloids examined were Bredig's platinum and various preparations made by Zsigmondy's method.

Using a *P.D.* of 13 volts between electrodes 1 cm. apart, the time required to traverse uniformly a path of 0·125 mm. was found to be four seconds for the gold granules, and 4·3 seconds for those of platinum. The mobility or velocity for a field of 1 volt per cm. is hence $26{\cdot}0 \times 10^{-5}$ cms. per sec. for gold, and $24{\cdot}0 \times 10^{-5}$ cms. per sec. for platinum. Burton's measurements (Abstr., 1906, ii, 275) gave the values $21{\cdot}6 \times 10^{-5}$ and $20{\cdot}3 \times 10^{-5}$ cms. per sec. for gold and platinum respectively. Electric transport measurements made on red, violet, and blue colloidal gold solutions, prepared according to Zsigmondy's method (Abstr., 1898, ii, 522), show that the method of preparation does not influence the nature of the colloidal metallic solution obtained, the charge of the granules remaining practically constant.

The radii of the gold granules, measured by means of a hæmatometer, were found to be: red gold, $1{\cdot}2 \times 10^{-5}$ cms.; violet gold, $1{\cdot}7 \times 10^{-5}$ cms.; blue gold, $2{\cdot}0 \times 10^{-5}$ cms.

If the granules carrying a charge, e, move in an electric field of intensity, ϕ, they are subjected to an electric force, $e\phi$, and their velocity is given by $k\phi$, where k is their mobility. Owing to the very great dilution (0·00006 gram of gold per c.c.), the internal friction, η, will be sensibly the same as if the granules moved in pure water. According to Stokes's law, the velocity of spheres of radius r in a medium having the internal friction η, under the influence of a force $f=e\phi$, is given by the expression: $v=e\phi/6\pi\eta r$, and since $v=k\phi$, $e=6\pi\eta kr$. The experimental determinations give the value $\eta=0{\cdot}01782/(1+\alpha t)$. The charge of Bredig's gold granules is hence $e=12{\cdot}19\times10^{-10}$ electrostatic units, the values for the other colloids being: Zsigmondy's red gold, $9{\cdot}75\times10^{-10}$; violet, $12{\cdot}19\times10^{-10}$; blue, $16{\cdot}2\times10^{-10}$; Bredig's colloidal platinum, $11{\cdot}32\times10^{-10}$. The charges on the granules are hence of the same order of magnitude as the charges carried by the ions. T. H. P.

Behaviour of Colloidal Suspensions with Immiscible Solvents. W. Lash Miller and R. H. McPherson (*J. Physical Chem.*, 1908, 12, 706—716).—The experiments were undertaken to ascertain if colloidal suspensions distribute themselves between two immiscible solvents on shaking. No such distribution was observed in the case of two liquids; the colloid usually coagulated on shaking (compare Winkelblech, Abstr., 1907, ii, 17).

More definite results were obtained with ternary systems which form two layers in the neighbourhood of the "plait point" (the point at which the layers become almost identical in composition). The binodal curve, tie-lines, and plait point have been determined directly at room temperature for a number of ternary systems, such as water-chloroform-alcohol, water-chloroform-acetone, and water-alcohol-ether, by a simple method. No distribution was observed with colloidal arsenious sulphide in the first two systems, but in the latter system and in certain other systems, distribution was observed in the neighbourhood of the plait point. It is, however, only for relatively clear solutions which approach true solutions in character that distribution has so far been obtained. G. S.

Has the Crystallising Force any Influence on Properties in the Amorphous Condition. Latent Heat of Vaporisation of *p*-Toluidine. W. A. Kurbatoff (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1487—1492).—The latent heat of vaporisation of *o*-toluidine, m. p. −40°, b. p. 198°, is 95·1, and Trouton's constant, 21·6 (compare Luginin, Abstr., 1903, ii, 7). The author's measurements of the latent heat of vaporisation of *p*-toluidine, m. p. 45°, b. p. 199·5°, give the value 91·8, Trouton's constant being consequently 20·6, the normal value. *p*-Toluidine is hence non-associated, and *o*-toluidine, associated. The author regards this difference as due to the difference in the crystallising powers of the two compounds. The crystallising power hence seems to be a molecular force, and to influence the properties of the compound in the amorphous condition.

The values of the Ramsay-Shields constant are different for the two toluidines, being 1·72 for the *p*-compound between 107° and 210·6°, and for the *o*-compound, 2·01 at 8·1—108·4° and 2·06 at 108·4—208·5°. T. H. P.

Forms of Matter. II. P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 282—304).—An account is given of methods which have been used in the preparation of crystalline substances in so-called colloidal amorphous forms. According to the author's theory (crystallisation theory of colloids), the amorphous condition has no real existence; "amorphous" substances represent sponge-like formations consisting of extremely minute crystals. In a large number of cases it has been shown that crystalline substances can be obtained in "colloidal" form, and, conversely, "colloidal" substances in crystalline form, by suitable variation of the conditions under which separation from solution takes place.

The character of the precipitate, which separates from a solution as the result of a chemical change (for example, the double decomposition of two salts), depends on the rate of formation and the solubility of the solid phase, the degree of association of the components of the solution which react to form the insoluble substance, and on the viscosity of the liquid medium. The fact that the rate of formation of the solid and the association of the components of the solution both increase when the concentration of the solution increases, enables the process of crystallisation to be regulated by varying the concentration of the solution. Starting out from solutions just saturated with respect to the slightly soluble substance, and progressively increasing the concentration of the reacting solutions, it is possible to distinguish five concentration intervals, according to the crystalline character of the the substance which separates out.

The character of the barium sulphate precipitate, which is obtained on mixing differently concentrated solutions of barium thiocyanate and manganous sulphate, is described and illustrated by photographs. The following intervals of concentration are distinguished. Between $N/20,000$ and $N/7000$ no precipitation takes place even when the solution is left for years. Between $N/7000$ and $N/600$ well-developed crystals separate out, whilst between $N/600$ and $0{\cdot}75N$ the precipitate consists of star-shaped and needle-like aggregates. From $0{\cdot}75N$ to $3N$, "amorphous" precipitates are obtained, distinguishable under the microscope as spherical granules, whilst between $3N$ and $7N$ "amorphous" precipitate, separate which cannot be differentiated either by the aid of the microscope or the ultra-microscope.

It is shown that the "amorphous" forms obtained in the fourth and fifth concentration intervals are actually crystalline. The minuteness of the crystals which result from these concentrated solutions is probably due for the most part to the very high velocity of formation.

The conditions for the preparation of a stable suspension of barium sulphate are considered, and it is shown that such a stable suspension can be obtained by mixing alcoholic solutions ($N/500$—$N/10$) of barium thiocyanate and cobalt sulphate. This is due to the increase in the number of centres of crystallisation consequent upon the diminished solubility of the barium sulphate. H. M. D.

[Forms of Matter.] MAX MÜNDEN (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 304—305).—A claim of priority in respect of P. P. von Weimarn's paper (preceding abstract). The author points out that he has previously demonstrated by microscopic observations that all forms of matter, organic and inorganic, are fundamentally identical. H. M. D.

[Forms of Matter.] P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1908, 3, 305).—In reply to Münden (preceding abstract) the author states that the question of the identity of living and dead matter has not been considered by him. H. M. D.

Conservation of Weight. Constantin Zengelis (*Zeitsch. physikal. Chem.*, 1909, 65, 341—358. Compare Abstr., 1906, ii, 831).—It is shown by a number of different methods that many gases and vapours of solids can pass through glass even at the ordinary temperature.

In one set of experiments, substances such as stannic sulphide and iodic acid, were supported inside a glass beaker inverted on a glass plate, the junction between plate and beaker being closed by paraffin. On the outside of the beaker, at the same height as the material inside, a piece of silver foil was fixed, and the whole arrangement was surrounded by a large inverted beaker, also closed air-tight with paraffin. After some days, the silver foil showed evidence of the action of the solid, which must therefore have passed in the form of vapour through the glass. In another set of experiments, chlorine, bromine, and iodine were sealed up in separate flasks on the outside of which were fixed strips of silver foil, and the flasks were then enclosed in separate air-tight vessels. The silver outside the chlorine vessel showed signs of attack after fifty days, that of the bromine vessel in about the same time, but in the case of iodine there was distinct action in three days. The effect was much more rapid when the outer vessel was exhausted.

The rate of action is not proportional to the volatility of the substance, and, in some cases at least, is not markedly accelerated by a moderate rise of temperature. The effect is the more rapid the thinner the glass walls.

The author considers that Landolt's experiments, contrary to the latest views of Landolt himself (Abstr., 1908, ii, 366), afford evidence of a real loss of weight in certain chemical reactions, and that the loss of weight is due to the passage of vapours through the glass walls. The fact that there is no loss of weight when the inner surface of the vessel is coated with paraffin (Landolt) is in favour of this view.

G. S.

Are the Stoicheiometric Laws Intelligible without the Atomic Hypothesis? Franz Wald (*Chem. Zeit.*, 1908, 32, 1249—1250, 1276—1279. Compare Abstr., 1908, ii, 367).—Polemical. A further reply to Kuhn (Abstr., 1908, ii, 826). W. H. G.

Combining Power of Metallic Atoms with Atoms of the Same Kind. Leopold Rügheimer (*Annalen*, 1908, 364, 51—63).—In a previous paper (compare Abstr., 1905, ii, 576), the author has pointed out that the tendency of atoms of metals to link together is very small even in non-ionised compounds; the only definite exception is tin triethyl, which, according to Ladenburg, has the formula Sn_2Et_6 (from vapour density determinations). The author has redetermined the molecular weight of this compound by the boiling-point method, ethyl ether being used as solvent. In the most dilute solution the value found is not much greater than that corresponding with the formula $SnEt_3$, but it increases rapidly with the concentration, so that the substance shows a considerable tendency to associate.

The remainder of the paper is occupied with a discussion on the nature of valency. G. S.

Physical and Chemical Properties as Functions of the Magnitude of the Granules (Number of Molecules in the Granule) of the Solid and Liquid Phases. P. P. VON WEIMARN (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1434—1447).—The author gives a résumé of the literature on this subject, and shows that some of Pawloff's conclusions (Abstr., 1908, ii, 927) are in entire disagreement with the results of previous investigators (compare also Abstr., 1908, ii, 90, 263, 1023). T. H. P.

Method to Avoid Cracking Vacuum Vessels whilst Manipulating Liquid Air. ENRIQUE HAUSER (*Anal. Fis. Quim.*, 1908, 6, 428—429).—A tube of paper rolled several times on itself is introduced into the mouth of the vacuum vessel so as to fit it closely and to pass halfway to the bottom of the vessel and project an equal distance outside. The liquid air can then be poured out through this tube without undergoing violent ebullition in the neck and without risk of cracking the vacuum vessel. W. A. D.

Inorganic Chemistry.

Direct Determination of the Atomic Weight of Chlorine with reference to Oxygen. PHILIPPE A. GUYE and G. FLUSS (*J. Chim. Phys.*, 1908, 6, 732—768).—The atomic weight of chlorine with reference to oxygen has been determined by the complete analysis of nitrosyl chloride, NOCl.

Nitrosyl chloride was prepared according to Tilden's method (Trans., 1874, 27, 634) by distilling a mixture of perfectly dry nitrosulphonic acid and sodium chloride, and purified by crystallisation and, finally, by fractional distillation. It has m. p. 61° and b. p. $-5\cdot6°$. Contrary to the statement of Sudborough (Trans., 1891, 59, 655), aluminium is not attacked by gaseous nitrosyl chloride in the cold; above 500°, however, interaction takes place, with formation of a white and a yellow substance, the former being aluminium chloride. Selenium and sulphur are changed to the lower chlorides, S_2Cl_2 and Se_2Cl_2, by the action of gaseous nitrosyl chloride. Silver foil does not completely decompose the gas, but the latter is decomposed quantitatively by heating with finely-divided silver at 400—500°, the chlorine being completely retained by the silver, and nitric oxide liberated.

The fact last mentioned has been taken advantage of for the quantitative analysis of the gas; the nitric oxide is split up and the oxygen retained by heated copper, and finally the nitrogen is retained by heated calcium. The precautions taken to obtain accurate results are fully described.

As a mean of five experiments, the value $Cl = 35\cdot468$ is obtained from the ratio Cl : O, and Cl = 35·471 from the ratio Cl : NO (N = 14·01). The most probable value is Cl = 35·466, obtained from the first ratio, which compares with the value Cl = 35·462 obtained by Edgar (H = 1·0076). From the experiments, the value N = 14·006 is obtained for the atomic weight of nitrogen, in good agreement with the international value.

The investigation is being continued. G. S.

The Deacon Process. Kurt Vogel von Falckenstein (*Zeitsch. physikal. Chem.*, 1909, **65**, 371—379. Compare Abstr., 1907, ii, 19, 538).—In the practical working of the Deacon process, 40% of hydrogen chloride and 60% of air are led through the apparatus heated at 430°. Under these conditions, 70—71% of the hydrogen chloride introduced is converted into chlorine, and it is shown theoretically that this mode of working is the most economical under ordinary conditions. Much better yields are obtained, however, as may be anticipated from theoretical considerations, when the issuing gas is freed from water by passing through sulphuric acid and then passed through a second Deacon tube, also at 430°; in this way the yield is raised from 71% to 83—85%, and by repeating the process a third time, to 87—89%, only slightly less than the theoretical value. This method ought to prove economical on the technical scale; as a matter of fact, a British patent embodying the suggested improvement has been in existence since 1895. G. S.

The Active Substance of Chlorates. H. Klopstock (*Chem. Zeit.*, 1908, **33**, 21).—A sample of potassium chlorate, which according to the usual tests contained either active chlorine, potassium chlorite, or an obscure oxychlorine compound, was found to be contaminated with potassium bromate. L. de K.

Action of Heat on Iodic Anhydride. Marcel Guichard (*Compt. rend.*, 1908, **147**, 1306—1309 *).—As a preliminary to the determination of the atomic weight of iodine with direct reference to oxygen by analysis of iodic anhydride, the effect of heat on the latter has been investigated. When heated above 300°, iodine and oxygen are given off, and the undecomposed solid becomes brown. It is now shown that the brown colour is due to traces of iodine, which, along with oxygen, is retained very energetically by the solid; the brown colour is not modified by heating for some hours at 270°, nor by treating the solid with carbon disulphide, benzene, ether, or fuming nitric acid. The only substances capable of removing the colour are those which are capable of dissolving the anhydride and combining with the iodine, for example, an aqueous solution of potassium hydroxide.

G. S.

Production of Ozone with Rotating Anodes. Franz Fischer and Kurd Bendixsohn (*Zeitsch. anorg. Chem.*, 1909, **61**, 13—39).—It has been shown previously (Fischer and Massenez, Abstr., 1907, ii, 162) that the best yields of ozone in the electrolysis of dilute sulphuric acid are obtained by the use of cooled platinum electrodes, the surface of which is divided into narrow strips by non-conducting material.

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* and *Bull. Soc. chim.*, 1909, [iv], 5, 86—89.

Rotation may be employed instead of internal cooling, and several forms of apparatus are described, having an anode rotating about a horizontal axis. The anode may consist of thin platinum wires, or of platinum foil embedded in glass, the edge being exposed by grinding, so that the anode surface is a line only 0·1 mm. in breadth. The best form is a thin disk of foil, the edge only of which is exposed. Such an anode yields oxygen containing 23·4% by weight of ozone. Unlike the wire electrodes, the yield of such a disk is not improved by rotation, although rotation increases the life of the platinum by removing the warm acid from its surface. The greater efficiency is due only to the narrowness of the anode surface. C. H. D.

Ozone Apparatus. Gustav Müller (*Chem. Zeit.*, 1908, 32, 1228).—A modification of Berthelot's apparatus for submitting a slow current of oxygen to the silent electric discharge in the annular space between two surfaces of an electrolyte. J. V. E.

Hydrogen Sulphide Generator. W. Th. Clous (*Chem. Weekblad*, 1908, 5, 889).—The generator consists of two tubulated aspirators, connected at the bottom by a stopcock and at the top by a tube bent twice at right angles. In the acid container, this tube ends just below the cork; in the sulphide container, it extends to the bottom. The acid container is fitted with a safety tube for introducing the acid, and the sulphide container with a glass stopcock for drawing off the gas.

A. J. W.

Compounds of Sulphur and Chlorine. Ernst Beckmann [with F. Junker and Theodor Klopfer] (*Zeitsch. physikal. Chem.*, 1909, 65, 289—337).—There are three well-defined chlorides of sulphur. Sulphur monochloride, S_2Cl_2, is a yellow liquid, b. p. 137—138°, m. p. $-75°$ to $-76°$. It has very little tendency to give off chlorine, nor has it much tendency to unite with chlorine at the boiling point of the latter even in the presence of the dichloride, but combination takes place at higher temperatures.

Sulphur dichloride, SCl_2, is a dark reddish brown liquid, b. p. 59°/760 mm., 22°/110 mm., and $-24°$/4 mm. It undergoes considerable decomposition when distilled at atmospheric pressure, but very little at lower pressures. It begins to solidify at $-80°$, and at $-88°$ forms a tallow-like solid, orange-yellow in colour. It begins to fuse when the temperature reaches $-78°$; $D^{15} = 1·622$.

Sulphur tetrachloride, SCl_4, is formed immediately when chlorine and sulphur dichloride are brought together at low temperatures. It is separated from mixtures of the composition S:4Cl to S:6Cl by freezing out, the excess of chlorine being removed by centrifugal action. It solidifies completely at $-70°$, but only fuses completely between $-30°$ and $-20°$. It has considerable tendency to lose chlorine, and at room temperature is probably to a great extent split up into sulphur dichloride and chlorine. The fact that the dichloride and tetrachloride do not fuse at the temperature of solidification is ascribed to the formation of isomeric or polymerised compounds.

In liquid chlorine at its boiling-point, both S_2Cl_2 and SCl_2 have the molecular weights corresponding with their formulæ, and the formula SCl_2 has also been confirmed by cryoscopic determinations in xylene, *p*-xylene, ethylene dibromide, acetic acid, and bromine.

The freezing-point constant for S_2Cl_2 is 53·6. In this solvent sulphur dichloride dissolves as SCl_2, sulphur as S_8, but the tetrachloride is insoluble. The freezing-point constant for sulphur dioxide is 30·1. G. S.

Action of Sulphur Chloride (S_2Cl_2) on Metalloids and Metals. PAUL NICOLARDOT (*Compt. rend.*, 1908, **147**, 1304—1306. Compare Abstr., 1908, ii, 1074).—Sulphur, selenium, white and even red phosphorus dissolve in sulphur chloride in the cold; in the latter case rapid effervescence occurs. Antimony is attacked in the cold, arsenic only on warming to 50°, and then only slightly, whilst carbon, silicon, and boron are not affected.

The majority of the metals, including the alkali and alkaline-earth metals, are not affected by sulphur chloride even at 136°. Silver, copper, and zinc are only slightly affected, but tin, aluminium mercury, and iron are attacked.

The action of sulphur chloride on iron has been studied in detail, the proportion of the products being determined by a special method of analysis. The main products are ferrous chloride and sulphide, in proportions depending on the conditions; practically no ferric chloride is formed. G. S.

Hydrates of Selenic Acid. ROBERT KREMANN and F. HOFMEIER (*Monatsh.*, 1908, **29**, 1111—1118).—With the object of ascertaining the composition of the hydrates formed by selenic acid, the authors have determined the freezing points of various mixtures of selenic acid and water. Only two hydrates are indicated by the data:

$$H_2SeO_4,H_2O,$$

melting at 26°, and $H_2SeO_4,4H_2O$, melting at −51·7°. The eutectic data are recorded: H_2SeO_4 and H_2SeO_4,H_2O, +19° and 91·5% selenic acid; H_2SeO_4,H_2O and $H_2SeO_4,4H_2O$, −56° and 74·0% selenic acid; $H_2SeO_4,4H_2O$ and H_2O, −83° and 43·0% selenic acid. Crystallisation of the tetra-hydrate is induced by the addition of the corresponding sulphuric acid hydrate, indicating that these are isomorphous.

H. M. D.

Synthesis of Ammonia by means of Peat. HERMANN WOLTERECK (*Compt. rend.*, 1908, **147**, 1402—1403).—The results of further experiments on the synthesis of ammonia under the catalytic influence of peat are described (compare Abstr., 1908, ii, 174). After passing the gases over 50 grams of peat at 450° for four hours, the ammonia produced amounts to 2·6—3·1 per 100 of the material burned. After four hours the percentage of nitrogen in the residue is greater than that in the peat, but after six hours there is a diminution in the percentage of nitrogen present. G. S.

Silicon Hydrides. PAUL LEBEAU (*Compt. rend.*, 1909, **148**, 43—45.* Compare Moissan and Smiles, Abstr., 1902, ii, 318, 560). —A large volume of mixed gases has been obtained by the action of hydrochloric acid on magnesium silicide. The first fraction yielded a gaseous product and a colourless liquid. The gas was again condensed, and, after repeated fractionation, the hydrides, SiH_4 and Si_2H_6, were obtained pure. The latter hydride had the calculated density, less than that found by Moissan and Smiles, whose preparation was probably contaminated with a higher hydride; practically pure Si_2H_6 boils about −7°. The colourless liquid above-mentioned explodes violently in contact with oxygen, and burns with a bright flame; it is unsaturated, and the probable formula is Si_2H_4. The spontaneous inflammability of the hydrides, SiH_4 and Si_2H_6, is probably due to the one last mentioned. Finally, a small amount of solid which turned brown in air was observed in the apparatus; this may be a solid silicon hydride. G. S.

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* and *Bull. Soc. chim.*, 1909, [iv], **5**, 89—91.

Products of the Arc and Spark Electric Discharge in Liquid Argon. II. Experiments with Hydrogen, Titanium, Tin, Lead, Antimony, and Bismuth. Franz Fischer and Georg Iliovici (*Ber.*, 1908, **41**, 4449—4457. Compare Abstr., 1908, ii, 1034).—Experiments are described with tubes fitted with "outside" electrodes, which show that argon must contain at least 4% of air before the spectrum lines due to admixed air appear. Furthur comparative experiments with argon (D 19·94) under 3·0, 0·3, and 0·03 mm. pressure in these tubes show that under the higher pressures the "red" argon spectrum appears, and the following lines, not observed by Travers, have been measured: λ 7600, 7465, 7380, 7235, 7130. At 0·03 mm. the red spectrum is no longer visible, the blue appearing.

Hydrogen, argon, and mixtures of these gases, when subjected to the silent electric discharge at the temperature of liquid air, undergo no change in volume, and therefore no alteration in molecular condition.

When titanium, tin, lead, antimony, and bismuth, elements from the fourth vertical column of the periodic system, are used as electrodes in the arc or spark discharge, nitrides in small quantities are obtained, which liberate nitrogen when heated in a vacuum, and give ammonium salts when treated with acids. This result is due to air introduced into the apparatus; the nitrogen, when removed by sparking with oxygen, left not a trace of argon behind. W. R.

Acid Sulphates. III. Joh. D'Ans (*Zeitsch. anorg. Chem.*, 1909, **61**, 91—95. Compare Abstr., 1906, ii, 351; 1907, ii, 459).—The solubility of sodium sulphate in water in presence of varying quantities of sulphuric acid has been further examined. The transformation temperature of $Na_2SO_4,10H_2O$ into Na_2SO_4 is lowered by the addition of sulphuric acid, the lowest point reached being 16·67° ± 0·07°. At this temperature the three solid phases, $Na_2SO_4,10H_2O—Na_2SO_4—Na_3H(SO_4)_2,H_2O$, are in equilibrium with the solution. The transition point of $NaHSO_4,H_2O$ is found to be 58·54° ± 0·05°, a temperature which is recommended as a thermometric fixed point. The isothermal at 25° was also determined. C. H. D.

Dissociation of Sodium Hydrogen Carbonate. Soury (*Compt. rend.*, 1908, **147**, 1296—1299).—The phase rule indicates that, in order that there may be a definite gas pressure over sodium hydrogen carbonate at a definite temperature, four phases must be present, for example, vapour, saturated solution, and two solid carbonates in contact with the latter.

Experiments were made in which a mixture of 27·54 grams of sodium hydrogen carbonate and 5·4 grams of water were heated at 100°, and the pressure measured after removal of the carbon dioxide in successive portions. The total volume of carbon dioxide obtainable from the above mixture is 3660 c.c. The tension of the carbonic acid decreases at first as the carbon dioxide is progressively removed, but there are two periods of constant pressure: (1) from the removal of 260 to 1760 c.c. of the dioxide; (2) from 2560 to 3210 c.c. In the first case, the two solid phases are the hydrogen carbonate and a lower carbonate of the composition $3Na_2O,4CO_2,5H_2O$; at the second period of constant pressure the solid phases are in all probability the salt last mentioned and the normal carbonate, Na_2O,CO_2,H_2O.

The dissociation pressure has also been determined at different temperatures, and the results are represented graphically. G. S.

Synthesis of Silver Nitrate and Determination of the Atomic Weight of Sulphur. Gustave D. Hinrichs (*Chem. Zentr.*, 1908, ii, 1410; from *Mon. Sci.*, 1908, [iv], 22, ii, 454—460).—Stas' synthesis of silver nitrate and Richard's determination of the atomic weight of sulphur are criticised and studied in the light of the author's method (Abstr., 1907, ii, 945). From the investigation of Stas and Marignac and the correct placement of the errors, absolute atomic weights have been arrived at for silver at 108, nitrogen 14, and for oxygen 16. The opinion is held that matter is simple, and chemical elements are combinations of simple matter having commensurable atomic weights.
J. V. E.

Atomic Weight of Silver. Anatole Leduc (*Compt. rend.*, 1908, **147**, 972—973).—An adverse criticism of a recent paper by Dubreuil (Abstr., 1908, ii, 1035). G. S.

Atomic Weight of Silver. Louis Dubreuil (*Compt. rend.*, 1908, **147**, 1300—1302. Compare Abstr., 1908, ii, 1035).—Polemical against Leduc (previous abstract). G. S.

True Atomic Weight of Silver. Gustave D. Hinrichs (*Compt. rend.*, 1908, **147**, 1302—1303. Compare previous abstracts).—In connexion with a recent paper by Dubreuil (Abstr., 1908, ii, 1035), the author has given up his recently expressed view (Abstr., 1908, ii, 573) that the atomic weight of silver is 107·875, and returns to his earlier opinion that it is exactly 108. G. S.

Atomic Weight of Silver. Anatole Leduc (*Compt. rend.*, 1909, **148**, 42—43).—Polemical against Dubreuil and Hinrichs (compare previous abstracts). G. S.

Warnerke's Modification of the Herschel Effect and the Preparation of the Substance of the Latent Image. A. P. H. TRIVELLI (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1908, 6, 438—442).—The film of an Agfa diapositive plate was removed, placed between two sheets of parchment paper, and subjected to high pressure by beating it with a hammer in a dark room. After this treatment, the film was found to be more easily developed than before, indicating that the α-silver subhaloid is insensitive to pressure.

On the basis of this observation, a method for the preparation of the α-subhaloid has been devised. Silver iodide, precipitated by an excess of potassium iodide and heated for a long time with ammonia, is mixed with a saturated solution of silver nitrate to absorb the free halogen and pounded in a mortar. The formation of the subhaloid is facilitated by heating at about 80°. The subhaloid so obtained is leaf-green in colour ; the corresponding subbromide is a little lighter.

H. M. D.

Old and New Subhalides. LOTHAR WÖHLER and G. RODEWALD (*Zeitsch. anorg. Chem.*, 1909, 61, 54—90. Compare Wöhler and Kasarnowski, Abstr., 1906, ii, 22).—The evidence for and against the existence of subhalides in coloured solid halides is discussed, and it is shown that this explanation of the colour is at least as probable as that of ultra-microscopic particles of metal. The present research is directed to the isolation and recognition of certain subhalides as chemical individuals.

Silver subfluoride, Ag_2F, is prepared in a pure state by the action of silver on a warm solution of silver fluoride, forms golden crystals, and is quite stable in dry air. It is insensitive towards even direct light, and thus differs markedly from other silver halides. A pressure of 20,000 atmospheres is also without influence. At 90° the solid in a dry state, or in contact with a saturated silver fluoride solution, decomposes into silver fluoride and silver. The heat of formation of Ag_2F is 26·3 Cal. Its formation from the fluoride is not, as Guntz supposed (Abstr., 1890, 1055), endothermic, but exothermic (0·7 Cal.). Silver fluoride shows a great increase of solubility at 50°, due probably to a transition from the hydrate, $AgF,2H_2O$, to the anhydrous salt.

Calcium subchloride, observed incidentally by Borchers and Stockem (Abstr., 1903, ii, 19), can only be prepared by heating calcium with dry calcium chloride in equivalent proportions in steel cylinders at 900—1000° for twenty-four hours, followed by rapid quenching in solid carbon dioxide and treatment with ethyl iodide, which allows of the separation of the subchloride and calcium by their density. The red crystals of CaCl, heated to 810° and allowed to cool slowly, show decomposition into chloride and metal. A small proportion of subchloride is sufficient to give a red colour to the chloride. The pure crystals have D^{20} 2·08.

Calcium subiodide, CaI, prepared by heating atomic proportions of calcium and iodine in a steel tube at 800°, quenching rapidly, and washing the mass with carbon disulphide, forms brown crystals, and, like the subchloride, decomposes if cooled slowly from 800°, yielding calcium iodide and calcium.

Calcium subfluoride, CaF, is prepared by heating calcium with calcium fluoride above 1400°, the steel tube being protected by wrapping in platinum foil and coating with basic fire-clay. The product forms orange crystals, D^{20} 2·305, and is much less readily attacked by moisture than the subchloride or subiodide. All these compounds are stable only at high temperatures, decomposing into metallic calcium and the normal halide when cooled slowly. C. H. D.

Formation of Fulminating Silver. A. SIEVERTS (*Zeitsch. angew. Chem.*, 1909, 22, 6—7).—A warning as to the danger incurred in working with ammoniacal silver solutions. Ten grams of silver nitrate were converted into oxide by potassium hydroxide, and the precipitate was digested at 40° with 45 c.c. of 6·7% ammonia for ten minutes. On the surface of the liquid a white crust had formed, and a heavy, black powder was noticed at the bottom of the utensil. In order to facilitate solution, this was stirred with a glass rod, when a violent explosion took place, doing much damage, and seriously wounding the operator. Even clear solutions may give rise to explosions.

L. DE K.

Crystalline Form of Calcium Carbonate Precipitated from Concentrated Solutions. EMIL HATSCHEK (*Chem. Zeit.*, 1909, 33, 49).—From concentrated solutions of calcium chloride and with various reagents, it is found that at all temperatures from 15° to the boiling point the precipitate consists almost exclusively of calcite. At temperatures below 15°, the carbonate is precipitated in granules, which, even when kept for some time under the mother liquor, do not become crystalline. L. DE K.

Experiments Showing the Formation of Nitrides of Barium, Strontium, Calcium, and Aluminium. H. RUSSELL ELLIS (*Chem. News*, 1909, 99, 4).—When the oxides of these metals are mixed with magnesium powder and ignited on an iron tray, the magnesium replaces the other metal, which, as soon as it is set free, combines with the oxygen and nitrogen of the air. With barium oxide, calcium oxide, and strontium oxide, the product obtained was quite yellow, and, when moistened with water, smelt very strongly of ammonia; with aluminium oxide, the product was black, but also smelt strongly of ammonia when water was added. The presence of carbonate, hydroxide, and peroxide with the oxides of the alkaline-earth metals increases the violence of the reaction and hinders nitride formation. Calcium oxide, if carbonate is present, gives neither nitride, carbide, nor cyanide; barium and strontium oxides containing appreciable quantities of carbonates yield nitride, cyanide, carbide, and possibly cyanamide. Excess of magnesium powder, as a rule, produces a larger yield of nitride, but never more than that which could be produced from the metal obtained from the oxide. The conclusion is drawn that the nitride produced is not that of magnesium, because when magnesium burns in air, either alone or admixed with the oxide of a metal not forming a nitride, less than 1% of nitride is obtained. Moreover, magnesium nitride readily burns, so that if great development of heat takes place, it could not exist. Estimations of nitrogen contained in the product from igniting the following mixtures gave: (BaO + Mg), 24·4% Ba_3N_2; (BaO + 2Mg), 43·3% Ba_3N_2; (SrO + Mg), 33·7% Sr_3N_2; (SrO + 2Mg), 53·8% Sr_3N_2; (CaO + Mg), 33·6% Ca_3N_2; (CaO + 2Mg), 31·5% Ca_3N_2; (Al_2O_3 + 3Mg), 11·1% AlN. J. V. E.

Certain Electrolytic Borates. MARIO G. LEVI and S. CASTELLANI (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 613—617).—The authors have applied the electrolytic method formerly employed (*Gazzetta*, 1907, **37**, ii, 562) for the preparation of borates of sodium to those of other metals. In the electrolytic cell employed, the metallic salt solution containing the platinum anode was separated by a diaphragm from the boric acid solution, in which the platinum cathode was placed.

With calcium, strontium, and barium salts, the crystalline cathode deposit and the first portions of the white, flocculent material precipitated in the cathode compartment have the composition

$$RO,B_2O_3,4H_2O \ (R = Ca, Sr, or Ba).$$

In the case of calcium salts, the later deposits in the cathode chamber consist of the pyroborate, CaB_4O_7, but with strontium and barium salts these deposits have indefinite compositions, as also do the precipitates obtained by the addition of alcohol to the cathode liquid. With magnesium salts, the cathode deposit seems to consist of the borate, MgB_2O_4, mixed with a large proportion of magnesium oxide; precipitation of the cathode solution by means of alcohol yields the borate, $3MgO,4B_2O_3$.

With salts of copper, cadmium, mercury, lead, iron, and nickel, no definite borates were formed. T. H. P.

Magnesium-Silicon Alloys. RUDOLF VOGEL (*Zeitsch. anorg. Chem.*, 1909, **61**, 46—53).—Molten alloys of magnesium and silicon readily pass through magnesia vessels, and strongly attack porcelain; it is therefore necessary to melt them in carbon tubes in an atmosphere of hydrogen, the porcelain tube enclosing the thermocouple being protected with a layer of carbon.

The freezing-point curve falls from the freezing point of silicon to a eutectic point at 950° and 42% of magnesium, rises to a maximum at 1102° and 63·2% Mg, corresponding with the compound Mg_2Si, falls to a second eutectic point at 645° and 96% Mg, and again rises to the freezing point of magnesium. Solid solutions are not formed.

The compound Mg_2Si forms glistening, hard, light blue crystals, slowly attacked by concentrated sulphuric and nitric acids, rapidly by dilute acids, with evolution of hydrogen. Hydrochloric acid attacks it violently, with evolution of silicon hydride.

The microscopic examination of the alloys confirms the above conclusions. C. H. D.

Compounds of Magnesium and Sodium Sulphates. A. S. GINSBERG (*Zeitsch anorg. Chem.*, 1909, **61**, 122—136).—The determinations of the freezing-point diagrams of the systems K_2SO_4–$MgSO_4$ and Na_2SO_4–$MgSO_4$ by the author (*Ber. St. Petersburg Polytech. Inst.*, 1906, 6) have been confirmed as regards the first system by Nacken (Abstr., 1908, ii, 692), but the second system gave somewhat different results. A re-examination of mixtures of sodium and magnesium sulphates has shown that the equilibrium is very complicated. The freezing-point curve has a eutectic point at 44·2 mol. % $MgSO_4$ and 670°, and a break at 71·3 mol. % and 814°. α-Sodium sulphate forms solid solutions containing up to 35·8 mol. % $MgSO_4$. The compound $Na_2SO_4,3MgSO_4$ melts with decomposition at 814°. Magnesium sulphate does not form solid solutions. The existence of two other compounds, $Na_2SO_4,MgSO_4$ and

$$3Na_2SO_4,MgSO_4,$$

formed only in the solid state, is also indicated. These compounds are identical with anhydrous blödite and vanthoffite respectively, the former existing in α-, β-, and γ-modifications. Sodium sulphate only forms two modifications, the transition point being at 232°.

C. H. D.

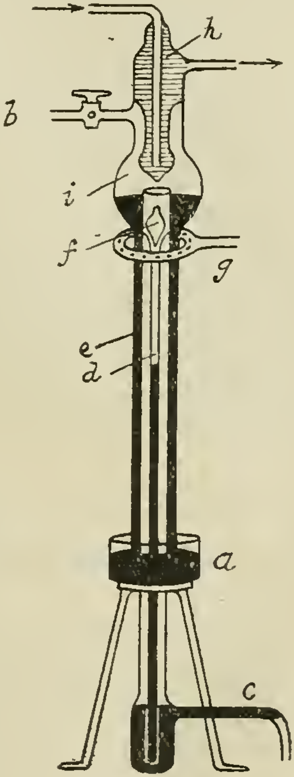
Gases Occluded in a Complex Brass, containing Manganese, which showed Numerous Flaws. G. Guillemin and B. Delachanal (*Compt. rend.*, 1908, **147**, 1309—1311).—The specimen of brass in question contained 60·15% of copper, 34·76% of zinc, 2·34% of manganese, and small amounts of tin, lead, iron, and aluminium, and was full of small holes due to escaping gas. Fifty grams of it were heated in a porcelain tube up to 1000°, and the gas given off, which amounted to 3·5 times the volume of the alloy, collected and analysed. It contained 79·1% of hydrogen, 3·9% of methane, 8·9% of carbon monoxide, and 8·1% of carbon dioxide.

G. S.

Variations in the Structure of Coinage Bronze during Working. Federico Giolitti and Ernesto Pannain (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 668—670).—The authors have made a metallographic study of the bronze used for Italian coinage, which contains 3·82% of tin, 95·80% of copper, and 0·38% of impurities (about 0·2% of lead). The polished surfaces of the specimens were treated repeatedly with hot 0·24% nitric acid, each such treatment being followed by gentle polishing with chromic oxide.

The cooled ingots, before treatment, consist of solid solutions, α, of heterogeneous concentration, among which are scattered crystals of the solid solution, β. According to the equilibrium diagrams of alloys of copper and tin (compare Giolitti and Tavanti, Abstr., 1908, ii, 946), bronze containing about 4% of tin should consist entirely of the α-mixed crystals, whilst in reality the above structure is nearer to that given by an alloy containing more than 8% of tin. The presence of the β-crystals is explained by the velocity with which the alloy cools. This velocity is not sufficiently slow to allow the first α-crystals, rich in copper, to react with the liquid, which becomes less and less rich in copper, and is in equilibrium with the crystals separating at continually lowering temperature, so as to give homogeneous mixed crystals. Nor is the velocity sufficiently rapid to prevent, at 790°, the reaction between the borders of the mixed crystals, rich in tin, and the residual liquid giving rise to the β-mixed crystals. After re-heating for half an-hour at about 800° and tempering in cold water, the heterogeneous masses of α-crystals are transformed into homogeneous crystals with a lamellar structure, among which are still seen the β-crystals. After flattening in the cold, both the α- and β-crystals are elongated in the direction of the flattening. Subsequent re-heating and tempering are accompanied by the appearance of α-crystals having a rectilinear outline, these and also the β-crystals being elongated by further flattening, whilst successive re-heating and tempering bring back the former crystalline structure, which undergoes only slight deformation during the final flattening. It is noteworthy that the β-crystals, formed during the initial cooling of the alloy, are preserved through all the various treatments to which the ingot is subjected.

T. H. P.



New Apparatus for the Distillation of Mercury. JOHANNES WETZEL (*Chem. Zeit.*, 1908, 32, 1228).—Mercury to be purified is placed in *a*, the bent tube *c* is placed in a dish containing pure mercury, and *b* is connected to a water-pump. By this means mercury is made to rise in both inner tube, *d*, and outer tube, *e*, until the mercury in *e* enters the bulbous enlargement, *i*, and is within about 2 cms. of the mouth of tube *d*. Water is made to circulate through the condensing head, *h*, and the mercury in *i* is heated by means of a gas ring, *g*. After about thirty minutes, *b* is closed, and mercury vapour condensing on the cold surface of *h* drops on to a float, *f*. When sufficient mercury has collected to lift the float, it falls down tube *d*, assisting to more completely evacuate the distillation bulb, *i*. By this arrangement, *i* may be almost completely evacuated, and the purified mercury obtained at *c*. Mercury boils at 155° when in the highest vacuum, so that if the apparatus described is made of Jena glass, there is little risk of it cracking. Indicative of the rapidity of distillation, it is mentioned that in ten hours nearly 23 kilos. of mercury may be obtained, showing a great increase over Kasten's method, generally employed, which gives in the same time only about 2½ kilos. of mercury.

J. V. E.

Use of the Colour Thermoscope. III. [Silver-Mercury Iodide.] H. Rebenstorff (*Chem. Zentr.*, 1908, ii, 1803; from *Zeitsch. phys.-Chem. Unter.*, 1908, 21, 291—304. Compare Lüdtke, *ibid.*, 10).—As a result of many physical and chemical experiments, it has been ascertained that a liberation of heat accompanies the transformation of yellow silver-mercury iodide at 45° into the orange form. Both modifications of this substance are found to exist in contact with one another for quite a considerable time at 33—45°. J. V. E

Distribution of Scandium. Wladimir I. Vernadsky (*Bull. Acad. Sci. St. Petersburg*, [vi], 1908, 1273—1274. Compare Eberhard, Abstr., 1908, ii, 862).—A criticism of Eberhard's conclusions regarding the mineralogical distribution and formation of the scandium compounds found in the crust of the earth. Z. K.

Aluminium. Analysis of Aluminium Powder. Émile Kohn-Abrest (*Compt. rend.*, 1908, **147**, 1293—1296).—The proportion of aluminium in commercial aluminium powder has been estimated by its reducing action on ferric sulphate, as previously described (Abstr., 1904, ii, 844), and also by measurement of the hydrogen given off when a known weight of it is treated with excess of hydrochloric acid. From a complete analysis, it is further shown that the specimen contains 95·93% of total aluminium as well as iron, silicon, carbon, nitrogen, and 2·29% of oxygen, the latter being obtained by difference. From the results of the two first methods of estimation, corrected for the action of the impurities on the reagents, it is shown that the specimen contains 92·5% of aluminium as metal. The amount of oxide present, deduced from this observation, is 5·72%, in excellent agreement with the direct determination. It is not certain that the oxide present is Al_2O_3. G. S.

Alum [Correction]. Robert Marc (*Zeitsch. anorg. Chem.*, 1908, 60, 459).—The results described in the previous paper (this vol., ii, 47) are untrustworthy, owing to the fact, which had previously escaped notice, that Merck's alum is contaminated with rubidium and cæsium. G. S.

The Decomposition of Felspar by Water. W. Funk (*Zeitsch. angew. Chem.*, 1909, 22, 145—146).—Finely-powdered felspar forms a colloidal suspension with water, chemical decomposition taking place at the same time, as shown by the alkaline reaction of the water. The attack on coarser particles may be shown by staining with methylene-blue and washing, when only the partly decomposed outer zone of each particle is found to be stained. Carbon dioxide hastens the attack, but lessens the tendency to form colloidal suspensions. Fused felspar is more rapidly attacked then the natural mineral.

C. H. D.

Variation of the Composition of Colloids formed in a Solution of Ferric Chloride according to the Conditions of Hydrolysis. Leopold Michel (*Compt. rend.*, 1908, **147**, 1288—1290. Compare Malfitano and Michel, Abstr. 1908, ii, 1042).—Further experiments on the variation in the composition of the colloidal particles with the conditions of hydrolysis of ferric chloride are described. The proportion of chlorine in the particles is usually greater the more slowly the solutions are warmed; it is the smaller the higher the temperature employed in hydrolysis and the less concentrated the solution. The effect of the addition of hydrochloric acid is to diminish both the quantity of colloid formed and the proportion of chlorine in it. G. S.

Hydrates and Acid Salts of Ferrous Sulphate. Frank B. Kenrick (*J. Physical Chem.*, 1908, 12, 693—705).—The composition of a number of ferrous sulphates and their range of existence in contact with sulphuric acid solutions at room temperature have been determined by solubility measurements in the usual way, and the results are represented in tables and diagrams. The composition of the solid phases could not be obtained directly, owing to the difficulty of separating them from the liquid phase, but this has been effected by a combination of two methods of indirect analysis, which are fully described.

The more important solid phases are as follows: FeO,SO_3,H_2O, minute, granular crystals, is stable in contact with solutions from $SO_3,2{\cdot}186H_2O$ to $SO_3,7{\cdot}93H_2O$, above which the heptahydrate is formed. $2FeO,3SO_3,2H_2O$ (composition somewhat doubtful) forms small, colourless, hexagonal crystals, and is stable between the limits of $SO_3,1{\cdot}637H_2O$ to $SO_3,2{\cdot}186H_2O$. $FeO,2SO_3,H_2O$ occurs in well-formed crystals, and is stable in contact with solutions from $SO_3,1{\cdot}342H_2O$ to $SO_3,1{\cdot}595H_2O$. $F_2O,4SO_3,3H_2O$, slender needles, is stable in contact with solutions from $SO_3,1{\cdot}122H_2O$ to $SO_3,1{\cdot}342H_2O$. The solubility of all the compounds in the liquid phases is very small, the tetra- and hepta-hydrates excepted. G. S.

Action of Hydrogen Peroxide on Metallic Sulphides. J. Ferrer y Hernández (*Anal. Fis. Quim.*, 1908, 6, 476—484).—Precipitated nickel sulphide decomposes hydrogen peroxide solution (3%) containing a trace of acid, nickel sulphate being formed; hydrogen peroxide solution rendered alkaline with sodium or potassium hydroxide does not, however, change nickel sulphide. Ammoniacal hydrogen peroxide rapidly dissolves nickel sulphide, giving a deep blue solution containing a complex ion.

Cobalt sulphide behaves like nickel sulphide with hydrogen peroxide containing a trace of acid; in presence of sodium or potassium hydroxide, however, it is oxidised to cobaltic hydroxide.

Ferrous sulphide is oxidised by hydrogen peroxide (acid), giving ferric sulphate or products formed by the hydrolysis of the latter. Manganese sulphide is, under similar conditions, converted into the sulphate, but, in presence of alkalis, manganese hydroxide and sulphur are formed. Zinc sulphide is oxidised by hydrogen peroxide containing a trace of acid to zinc sulphate; in presence of alkali, soluble zincoxides are formed. W. A. D.

Borotungstic Acids. HIPPOLYTE COPAUX (*Compt. rend.*, 1908, 147, 973—976. Compare Klein, Abstr., 1883, 23, 786; 1884, 559, 1266).—Two complex borotungstic acids have been prepared as follows. To one part of normal sodium tungstate and 1·5 parts of boric acid sufficient water is added to form a clear solution at the boiling point. After some time a precipitate separates. The mother liquors are concentrated, more boric acid added, a further precipitate is rejected, and to the mother liquors, which now contain complex borotungstic acids, ether and 2 to 3 volumes of sulphuric acid are added and the mixture shaken. The resulting oil is decomposed by cold water, and on evaporation in a vacuum the complex acid, $B_2O_3,28WO_3,6H_2O+56H_2O$ separates in hexagonal crystals. From the same solution the other acid is obtained as the insoluble barium salt by adding barium carbonate; the barium salt is decomposed by sulphuric acid, and the acid $B_2O_3,24WO_3,5H_2O+61H_2O$ obtained in octahedral crystals by evaporation.

The acid occurring in hexagonal crystals is hexabasic, and not very stable; the other acid is more stable, and is isomeric with silicotungstic acid, $Si_2O_4,24WO_3,4H_2O+62H_2O$, although the formulæ do not correspond, and the borotungstic acid, unlike the latter, is pentabasic.

G. S.

Preparation of Urano-uranic Oxide and a Standard of Radioactivity. HERBERT N. McCOY and GEORGE C. ASHMAN (*Amer. J. Sci.*, 1908, [iv], 26, 521—530).—Pure urano-uranic oxide, U_3O_8, can readily be prepared by heating any higher or lower oxide of uranium for some time in air at 700°.

Uniform films of the oxide, 7 cms. in diameter and weighing 0·6 to 0·8 gram, have been prepared in flat, circular tin dishes or copper plates as previously described (McCoy and Ross, Abstr., 1908, ii, 80); the thickness of the film is such that the α-ray activity is definite and constant, and the films are therefore suitable standards of radioactivity.

The α-ray saturation current for such a standard film is $5{\cdot}79\times10^{-13}$ amp. per cm.^{2}; from this result it is calculated that the total α-ray ionisation current of 1 gram of uranium is $4{\cdot}61\times10^{-10}$ amperes.

G. S.

Molecular Weight of Uranium Tetrachloride in Boiling Bismuth Chloride Solution. LEOPOLD RÜGHEIMER and L. GONDER (*Annalen*, 1908, 364, 45—50).—The molecular weight of uranium tetrachloride in boiling bismuth chloride solution, as determined by the special method already described, is 373, as compared with the calculated value, 380·3, for the formula UCl_4. G. S.

Reduction of Uranyl Chloride. WILLIAM ŒCHSNER DE CONINCK (*Compt. rend.*, 1908, 147, 1477—1478).—The author has made experiments to ascertain whether the reduction of uranyl chloride by hydrogen at a red heat can be used as a method for the determination of the atomic weight of chlorine. The results are not sufficiently concordant for the purpose. H. M. D.

Alloys of Silicon with Tin, Lead, and Thallium. S. TAMARU (*Zeitsch. anorg. Chem.*, 1909, 61, 40—45).—Liquid silicon and tin are miscible in all proportions, and, on cooling, pure silicon separates, the eutectic being practically pure tin. The freezing-point curve falls very slowly until about 80% Sn is reached, and then very rapidly.

Silicon is not miscible to an appreciable extent with either lead or thallium in the liquid state. C. H. D.

Preparation of Chloride of Thorium. CAMILLE MATIGNON (*Compt. rend.*, 1908, 147, 1292—1293 *).—The author considers that the use of a mixture of chlorine and sulphur chloride (S_2Cl_2) as a reagent for the preparation of anhydrous chlorides, such as that of thorium, from the corresponding oxides, already recommended (Abstr., 1904, ii, 340) is preferable to the employment of carbonyl chloride, recently used by Chauvenet (this vol., ii, 53).

The value +53·8 Cal. has been obtained for the heat of solution of thorium chloride (1 mol. in 2700 mols. of water) at 18°, as compared with +56·75 Cal. obtained by Chauvenet (*loc. cit.*). G. S.

Spitting of the Acid Vanadates of Univalent Metals. WILHELM PRANDTL and HANS MURSCHHAUSER (*Zeitsch. anorg. Chem.*, 1908, 60, 441—445).—In a previous paper (Abstr., 1908, ii, 46) the composition of the vanadylvanadates, $xM_2O,(y-z)V_2O_5,zV_2O_4$, present in the solid state after the evolution of oxygen from certain alkali acid vanadates on solidification was determined, and it was shown that the volume of oxygen given off from the potassium and lithium vanadates was less than the calculated amounts, a result ascribed to the incompleteness of the respective reactions. To test this view, the vanadylvanadates in question have been repeatedly fused and allowed to resolidify in an atmosphere free from oxygen. After 50 fusions, the amount of oxygen given off from the potassium compound corresponds with the formula for this compound previously given, but even after 100 fusions the oxygen obtained from the lithium compound is less than that corresponding with the composition previously given, $4Li_2O,V_2O_4,7V_2O_5$, and it must therefore be assumed that the compound present has the formula $6Li_2O,V_2O_4,11V_2O_5$. G. S.

Action of Antimony Trichloride on Nickel: Formation of NiSb. ÉMILE VIGOUROUX (*Compt. rend.*, 1908, 147, 976—978. Compare Lossen, Abstr., 1906, ii, 361).—When nickel is heated in a tube at 800° and antimony trichloride passed over it, a vigorous reaction takes place, and nickel chloride and nickel antimonide are formed. The former is removed by treatment with water, and the heating in antimony trichloride repeated, until finally only the antimonide, NiSb, remains as a crystalline powder. When the heating is carried out at higher temperatures, the residues become progressively poorer in antimony.

The compound NiSb has also been prepared by direct combination of the elements.

Nickel antimonide, NiSb, occurs in lustrous, reddish-violet crystals, which are non-magnetic and have $D^0 = 7·70$. It fuses at 1100° and decomposes at 1400°. It is vigorously acted on by chlorine and by oxygen when heated to dull redness. It is not affected by concentrated hydrochloric acid, but is decomposed by warm concentrated sulphuric acid and by warm nitric acid. It is scarcely affected even by fused alkalis. G. S.

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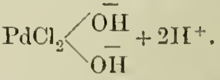
* and *Bull. Soc. chim.*, 1909, [iv], 5, 92—93.

Bismuthous Compounds. III. Walter Herz (*Zeitsch. anorg. Chem.*, 1909, 61, 119—121).—The freezing-point determinations of Eggink (Abstr., 1908, ii, 1043) indicate the existence of BiCl and BiBr only, and are thus in disagreement with the results of Herz and Guttmann (Abstr., 1908, ii, 199), which showed maxima corresponding with the formulæ $BiCl_2$ and $BiBr_2$. Both series of experiments gave concordant figures, and the cause of the difference is unexplained.
C. H. D.

Dichloropalladous Acid. Italo Bellucci and Pietro de Cesaris (*Gazzetta*, 1908, 38, ii, 602—614).—The addition of a silver salt to an aqueous solution of palladous chloride results in the precipitation, not of silver chloride, but of a compound corresponding with the formula $PdCl_2(OH{\cdot}Ag)_2$. The conclusion is hence drawn that the aqueous palladous chloride solution contains an acid, termed dichloropalladous acid, dissociated thus:  $PdCl_2\!\left\langle\begin{matrix}\overset{-}{OH}\\ \overset{-}{OH}\end{matrix}\right. + 2H^+$. The silver salt, and also the lead and thallium salts, of dichloropalladous acids are obtained as amorphous precipitates having the formulæ $[PdCl_2(OH)_2]Ag_2$, $[PdCl_2(OH)_2]Pb,Pb(OH)_2$, and $[PdCl_2(OH)_2]Tl_2$ respectively. The silver salt is hydrolysed slowly by hot water, and the other two salts more rapidly. T. H. P.

Pulverisation [Volatilisation] of Iridium in Water Vapour and Carbon Dioxide. Experiments to Determine the Density of Carbon Dioxide by the Method of Diffusion. Friedrich Emich (*Monatsh.*, 1908, 29, 1077—1085).—The author's attempts to measure the dissociation of carbon dioxide at high temperatures by observing the rate of diffusion of the gas through an aperture in an iridium tube have not been successful, because of the change in the aperture consequent on pulverisation of the metal.

The rate of pulverisation of electrically-heated strips of iridium in water vapour and carbon dioxide has been determined at a series of temperatures and under different gas pressures. The velocity of the process, which is supposed to be due to the formation of a volatile oxide, IrO_4, increases rapidly with the temperature. In the case of water vapour the velocity increases when the pressure is reduced from 1 to 0·1 atmosphere. On the other hand, for carbon dioxide the velocity increases when the pressure is reduced to 0·5 or 0·25 atmosphere, and then increases on further reduction of the pressure.

At 1900° the rate of pulverisation in carbon dioxide is almost twice as large as in water vapour, whilst at 2100° very little difference can be observed. This is said to be in agreement with the data relative to the dissociation of the two gases. H. M. D.

Complex Iridium Compounds. ALFRED WERNER and O. DE VRIES (*Annalen*, 1908, 364, 77—127).—The preparation and properties of a number of iridium compounds, mainly chloronitrito-, amminonitrito-, and chloroammino-compounds, are described.

Sodium iridiotetranitritodichloride, $[IrCl_2(NO_2)_4]Na_3,2H_2O$ (salt *A*), one of the salts intermediate between $[IrCl_6]M_3$ and $[Ir(NO_2)_6]M_3$, examples of which are already known, has been prepared as follows: 5 grams of sodium iridichloride, $Na_2IrCl_6,6H_2O$, are heated at 80—90° with 80 c.c. of water, 40 grams of sodium nitrite added gradually, and the solution warmed until it becomes yellowish-red and transparent. After a time, a salt, *A*, separates in well-formed, orange crystals, solubility 1 in 0·87 parts of water at 25°. From the mother liquors other products have been obtained, but not yet fully investigated. Salt *A*, in smaller yield, is also obtained by the action of sodium nitrite on ammonium iridichloride. Salt *A* has been obtained in the anhydrous form by crystallisation from dilute alcohol; it occurs in small, pale yellow crystals. The corresponding *potassium* salt, $[IrCl_2(NO_2)_4]K_3$, is obtained by repeated crystallisation from solutions containing salt *A* and excess of potassium nitrate; it forms small, light yellow crystals, and is less soluble than the sodium salt. By double decomposition between salt *A* and ammonium chloride, a yellow, crystalline precipitate was obtained, which has not been fully investigated; it is not the corresponding ammonium salt. The *lead* salt, in an impure form, was also obtained by double decomposition.

Nitritoamminiridium Compounds.—Trinitritotriamminiridium,

$$Ir[(NO_2)_3(NH_3)_3],$$

is obtained in thin, lustrous, colourless scales by heating 1 gram of salt *A* with 4 c.c. of 27% ammonia for eighteen hours in a sealed tube at 135—140°; the solution is evaporated, and the salt crystallised repeatedly. It is only freed from chloride with great difficulty, most satisfactorily by boiling with sodium nitrite. It is not affected by boiling hydrochloric acid (1 : 1), sulphuric acid (1 : 5), or concentrated nitric acid, but is decomposed when heated with concentrated sulphuric acid to 85°. One part of the compound dissolves in 2570 parts of water at 25°; the aqueous solution is practically a non-conductor.

Dinitritotetramminiridium chloride, $[Ir(NO_2)_2(NH_3)_4]Cl$, is obtained by heating 5 grams of salt *A* with 20 c.c. of 27% ammonia for eighteen hours at 170°, and evaporating the product on a water-bath. The leaflets which first separate are contaminated with nitrite, and the salt is obtained pure by dissolving in water and crystallising repeatedly in the presence of hydrochloric acid; solubility 1 in 16·8 parts of water at 55°. Its behaviour towards the mineral acids is, in most cases, similar to that of the salt last mentioned. The following compounds are prepared from the chloride by double decomposition, generally with alkali salts. The *bromide*, $[Ir(NO_2)_2(NH_3)_4]Br,H_2O$, occurs in colourless rods or prisms; the anhydrous bromide, obtained by recrystallisation in the presence of hydrobromic acid, in colourless prisms. The *iodide* occurs in colourless leaflets, crystals, or prisms; the *sulphate*, $[Ir(NO_2)_2(NH_3)_4]_2SO_4,\frac{1}{2}H_2O$, in prisms or needles, which become anhydrous on heating to 120°. The solubility is about 1 in 400 of water at room temperature.

Nitritopentamminiridium chloride, $[IrNO_2(NH_3)_5]Cl_2$, can also be obtained by the action of ammonia on salt *A*, but in better yield by the action of silver nitrite on the aquopentammine chloride (compare Palmaer, Abstr., 1896, ii, 179 : 1897, ii, 44) ; it forms small, colourless crystals, readily soluble in water. It is scarcely affected by boiling with nitric acid or aqua regia, or by moderately strong hydrochloric acid. The *iodide* and the *sulphate* are both anhydrous, and form colourless needles. *Acid nitritopentamminiridium sulphate*,

$$[\{IrNO_2(NH_3)_5\}SO_4]_4,3H_2SO_4,$$

obtained by the action of concentrated sulphuric acid on the chloride, forms colourless, transparent needles. The *nitrite*, obtained by interaction of the chloride and silver nitrite, also forms colourless crystals.

Chloroamminiridium Compounds.—The compound $[IrCl_3(NH_3)_3]$ appears to be formed when trinitritotriamminiridium,

$$[Ir(NO_2)_3(NH_3)_3],$$

is heated with ammonium chloride and hydrochloric acid to 180°, but attempts to obtain it pure were unsuccessful.

Dichlorotetramminiridium chloride, $[IrCl_2(NH_3)_4]Cl,H_2O$, is obtained by heating together 1 gram dinitritotetrammine chloride, 1 gram ammonium chloride, and 15 c.c. of concentrated hydrochloric acid for nineteen hours at 140°. It occurs in light yellow needles and prisms, which are finally purified by repeated crystallisation from water. It is not affected by boiling hydrochloric acid ; on heating with silver nitrite, even the intra-radicle chlorine reacts. It does not lose all its water even on prolonged heating at 125—130°. The corresponding *bromide*, yellow needles, crystallises with $1H_2O$, which it loses at 80°; the *sulphate*, yellow scales, has also $1H_2O$, which it retains at 120° ; the *iodide*, yellow needles, is anhydrous. By the action of iridium chloride and of potassium iridium chloride on dichlorotetramminiridium chloride, sparingly soluble precipitates are obtained, but no pure salt has been isolated. The dichlorotetrammino compounds just described appear to be identical with those obtained by Palmaer (*loc. cit.*) by the action of ammonia on iridium chloride. G. S.

Mineralogical Chemistry.

Fossil Coals. EDUARD DONATH (*Chem. Zeit.*, 1908, 32, 1271—1273).—The extract obtained by treating coal from Rossitz, near Brünn, with carbon disulphide or chloroform is found to contain anthracene, chrysene, and probably also carbazole, indene, and polymerised coumarones. The view put forward previously (*Zeitsch. angew. Chem.*, 1906, 19, 657), namely, that the formation of coal is accompanied by a process of distillation under pressure, and that coal consists of small quantities of a variety of pitch with the solid carbon material, thus receives support. W. H. G.

Influence of Centrifugal Force on the Optical and Other Properties of Naphtha. Michael A. Rakusin (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1583—1588).—The author has made experiments to ascertain whether the rotation of the earth has any effect on the properties of naphtha. A closed tube containing a sample of Grosny naphtha, D^{15} 0·8791, having a carbonisation constant of 3/32%, was spun for two hours in a centrifuge revolving 3000 times per minute, after which it was found to have the carbonisation constant 1/8% and D^{15} 0·8768.

Evidently a considerable part of the products of carbonisation had settled on the conical bottom of the tube. So that, whilst natural filtration of naphtha produces a differentiation of naphtha in a vertical direction, an analogous process in a horizontal direction may be brought about by centrifugal force. The author considers that such action has some bearing on the formation of asphalte, and may explain why asphaltes having a venous character are met with in some parts of the earth. T. H. P.

Rinneite. H. E. Boeke (*Chem. Zeit.*, 1908, **32**, 1228).—An anhydrous mineral, having the composition $FeCl_2,3KCl,NaCl$, has been found in considerable quantities at the Nordhäusen Works. It crystallises in the hexagonal system; it decomposes when exposed to the air, but is stable under petroleum, and when a hot saturated aqueous solution is allowed to cool, potassium chloride separates out.

J. V. E.

Analysis of Plumosite from Felsöbánya. Josef Loczka (*Ann. Musei Nat. Hungarici*, 1908, **6**, 586—590).—The material consists of a felted aggregate of dark steel-grey fibres with entangled quartz crystals. Neither the colour nor the lustre is affected by a 25% solution of sodium hydroxide, proving the absence of stibnite (which under these conditions quickly loses its lustre and becomes red); with a 30% solution, the material acquires a coloured tarnish, although still retaining its lustre. It is not acted on by an 8% solution of potassium sulphide. Analysis gave:

S.	Sb.	Pb.	Cu.	Fe(Mn,Zn).*	Insol.	Total.
21·59	35·80	39·38	trace	2·87	0·50	100·14

* Mn about 0·12, Zn about 0·10 per cent.

No iron-pyrites could be detected. The formula is deduced as $4PbS,FeS,3Sb_2S_3$ [but the figures agree still more closely with the jamesonite formula, $7(Pb_{\frac{4}{5}},Fe_{\frac{1}{5}})S,4Sb_2S_3$ (Abstr., 1907, ii, 700)].

L. J. S.

A Group of Manganates, comprising Hollandite, Psilomelane, and Coronadite. L. Leigh Fermor (*Rec. Geol. Survey India*, 1908, **36**, 295—300).—Hollandite (Abstr., 1907, ii, 701) has recently been described as a manganate of manganese, barium, and iron corresponding with the hypothetical acid, H_4MnO_5, an acid suggested by Laspeyres, in 1876, to explain the composition of psilomelane. It is here pointed out that the new mineral coronadite (Abstr., 1905, ii, 96) may also be referred to the same acid, the formula being $Mn_{21}Pb_6R''_5(MnO_5)_{16}$. These three minerals therefore form a group of manganates. L. J. S.

Whewellite from Schlan, Bohemia. FRANTIŠEK SLAVÍK (*Bull. Intern. Acad. Sci. Bohême*, 1908, 13, 9 pp.).—A crystallographic description is given of some large (up to 37 mm. across) twinned crystals of whewellite, found with crystals of ankerite and barytes in a fault-breccia in the Theodor coal mine near Schlan. The individual crystals have D 2·223, 2·222, 2·229. Analysis by J. Milbauer agrees with the formula CaC_2O_4,H_2O:

CaO.	C_2O_3.	H_2O.	Total.
38·46	49·65	12·12	100·25

L. J. S.

Study of Hydrated Silicates. FERRUCCIO ZAMBONINI (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1908, [iii], 14, 148).—The author has examined about thirty hydrated silicates with reference to the condition of the water present, the main results being as follows.

Thaumasite contains only water of crystallisation, and is to be regarded as $CaSiO_3,CaCO_3,CaSO_4,15H_2O$. Pyrosmalite, regarded up to the present as an orthosilicate, is a metasilicate,

$$(SiO_3)_2[R(OH),Cl]_4H_2.$$

Ekmanite is not allied to pyrosmalite, but is an altered chlorite. Calamine contains only $\frac{1}{2}$ a mol. of water of constitution, its probable formula, considering its crystallographic relations with bertrandite, being $Zn_2(ZnOH)_2Si_2O_7,H_2O$. Cordierite has no water of constitution. Dioptase is not an acid orthosilicate, but a metasilicate with dissolved water. Katapleite does not contain water of constitution, and is the sodium salt of a zircon-silicic acid; the same is the case with elpidite. The water present in steenstrupite and epistolite is not water of constitution. Sepiolite, which is regarded as a meta- or an ortho-silicate, contains absorbed water, and must be given the formula $Mg_2Si_3O_8,nH_2O$. The minerals collected together under the name of deweylite have, so far as the water present is concerned, properties analogous to those of sepiolite, but must be distinguished as deweylite, $Mg_4Si_3O_{10},6H_2O$, and pseudodeweylite, $Mg_3Si_2O_7,3H_2O$.
T. H. P.

Optical Characters of Minerals of the Amphibole Group and their Relation to the Chemical Composition. STEFAN KREUTZ (*Sitzungsber. K. Akad. Wiss. Wien.*, 1908, 117, Abt. 1, 877—972).—Detailed determinations were made of the optical constants of a number of minerals of the amphibole group; analyses are given of the following: I, grünerite from La Mallière, dep. Var.; II, tremolite from Switzerland; III, actinolite from Zillerthal; IV, richterite from Langban, Sweden; V, hornblende from Russell, New York; VI, pargasite from Pargas, Finland; VII and VIII, basaltic hornblende from Lukow, Bohemia.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	F.	Total, less O for F.	Sp. gr.
I.	47·17	—	1·00	1·12	43·40	0·08	1·90	2·61	0·07	0·47	2·22	0·07	100·08	3·518
II.	58·22	—	1·37	0·04	0·61	0·04	12·95	23·97	0·04	0·24	2·17	0·17	99·75	2·980
III.	56·38	—	1·23	0·15	5·26	0·30	12·41	21·74	0·22	0·48	1·96	0·09	100·18	3·044
IV.	56·01	—	0·14	2·14	—	5·81	8·29	20·99	0·47	3·69	1·94	0·18	99·59	3·044
V.	54·75	—	2·23	0·85	1·49	0·15	11·36	22·54	1·10	2·40	2·16	0·85	99·50	3·033
VI.	48·38	0·05	10·83	0·76	1·56	0·04	12·24	20·78	1·38	2·69	0·91	1·82	100·68	3·095
VII.	39·60	2·50	18·51	5·50	2·26	0·74	12·57	14·11	1·87	2·58	0·26	0·10	100·63*	—
VIII.	39·90	2·90	17·03	4·14	4·00	0·23	12·70	14·39	2·19	2·51	0·48	—	100·47	—

* CO_2, 0·07.

No definite relation can be traced between the chemical composition and the optical characters of the amphiboles except in tremolite-actinolite. The strength of the double refraction, for instance, does not vary progressively with the percentage of iron; and even in the colour of the material there is no such relation, for the highly ferruginous grünerite is pale yellow, whilst others containing less iron are dark green, and glaucophane is blue or violet. The amphiboles are therefore not to be considered as mixtures of simple salts, such as $FeSiO_3$, $Al_2Si_3O_9$, etc., but are complex compounds as suggested by Tschermak's double salts. L. J. S.

Composition of the Sand from the Eruption of Vesuvius, April, 1906. Giulio Paris (*Chem. Zentr.*, 1908, ii, 1287; from *Staz. sperim. agrar. ital.*, 1908, 41, 321—328).—Sand collected two days after the eruption had the following percentage composition:

Cl.	SO_3.	SiO_2.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	NiO.
41·45	12·67	0·25	4·05	3·58	2·5	7·48	27·51	0·46

and the acidity, calculated as hydrochloric acid, was 7·68%. Casoria (*Ann. R. Scuola Super. Agric. Portici*, 1907, 7) considered from his analysis that it contains a new nickel mineral:

SiO_2.	NiO.	MgO.	Co, Fe, Al, Ca.	Water.	Volatile.
35·014	44·75	4·528	trace	4·528	9·81

together with a small quantity of magnesium hydroxy-oxide and another silicate of the composition:

SiO_2.	NiO.	MgO.	Co, Fe.	Water.
39·756	19·348	26·808	trace	13·888

The ash that fell in the Province of Avellino had D 1·215, and contained an average of 0·6% phosphoric acid and 10% of alkali, of which latter 50% was soluble in acids. Some specimens contained varying quantities of nitrogenous substances which liberated ammonia when heated with soda-lime. J. V. E.

Composition of the Ash and Lapilli from the Eruption of Vesuvius, April, 1906. Napoleone Passerini (*Staz. sper. agrar. ital.*, 1907, 40, 40—53).—A sample of ash (1) and lapilli (2) were found to have the following composition:

	K_2O.	Na_2O.	MgO.	CaO.	FeO.	Fe_2O_3.	Al_2O_3.	P_2O_5.	SO_3.	TiO_2.	SiO_2.	Cl.
I.	5·43	3·54	4·76	10·80	4·01	4·41	17·84	0·66	0·17	1·02	46·72	0·34
II.	2·52	3·54	3·28	16·92	4·81	4·71	13·64	0·63	0·10	1·31	47·60	0·16

The acidity is only slight, and is mainly due to volatile acids (hydrochloric and sulphurous), which soon disperse if the ash is left exposed to air and not ploughed in.

The ashes resemble qualitatively those examined by Vauquelin and by Lavini in 1822 and 1829 respectively. The proportions of the different constituents vary, however, considerably (compare Lacroix, Abstr., 1906, ii, 555). N. H. J. M.

Lavas of the Last Eruption of Vulcano, Lipari Islands.

ALFRED LACROIX (*Compt. rend.*, 1908, **147**, 1451—1456).—During any one period of eruption the magmas of Mt. Pelée, of Vesuvius, and of Etna have in each case proved to be almost constant in chemical composition. From the various published descriptions of the products of the 1888—1889 eruption of Vulcano, this would, however, not appear to hold good; but two analyses now given of trachyte with anorthoclase, augite, and olivine are practically identical. Analyses are also given of microsanidinite occurring as enclosures in the trachyte, of glassy rhyolite, and of leucite-tephrite from Vulcanello.

L. J. S.

Investigations on the Eruptive Basic Rocks of Northern Sardinia.

AURELIO SERRA (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 597—602).—The rocks of the Fenosu district of Northern Sardinia have a felspar basis, which exhibits inclusions of augite, hypersthene, magnetite, biotite, apatite, and ilmenite. The following is the chemical composition of the rock:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	TiO_2.	P_2O_5.	CaO.
48·72	22·56	1·08	3·74	0·77	0·50	0·50	10·00

MgO.	K_2O.	Na_2O.	H_2O (at 110°).	H_2O (at red heat).	Total.
2·68	2·05	4·65	0·84	1·88	99·87

In the region of S'Adde de S'Ulmer, the rock, which is dark grey, contains large crystals of felspar (labradorite), smaller crystals of augite, together with magnetite, biotite, apatite, and hypersthene, and has the following composition:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	TiO_2.	P_2O_5.	CaO.
52·13	20·55	5·13	1·86	0·71	0·40	0·27	9·22

MgO.	K_2O.	Na_2O.	H_2O (at 100°).	H_2O (at red heat).	Total.
2·07	2·90	3·35	0·40	1·22	100·21

The two rocks belong to the same eruptive magma. T. H. P.

Rocks from Central Borneo.

J. SCHMUTZER (*Proc. K. Akad. Wetensch. Amsterdam*, 1908, **11**, 398—415).—Detailed descriptions and analyses, by M. Dittrich, are given of (I) glassy amphibole-dacite; (II) ditto; (III) biotite-amphibole-andesite; (IV) aplitic micro-granite: the first three rocks being from the Müller Mtns., and the last from Mt. Kĕlam.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	66·16	0·50	15·39	1·25	1·72	0·90	3·47	3·94	2·00	4·94	100·27
II.	65·72	0·48	15·06	1·35	1·80	1·57	4·18	4·24	1·07	4·46	99·93
III.	62·78	0·56	17·16	1·96	2·31	2·32	4·84	4·11	2·15	1·12	99·58 *
IV.	72·44	trace	16·51	0·24	0·52	0·05	2·47	4·54	2·13	1·26	100·16

* Including P_2O_5, 0·15; MnO, 0·06; BaO, 0·01.

L. J. S.

Meteoric Iron. WALTER FRAENKEL and GUSTAV TAMMANN (*Zeitsch. anorg. Chem.*, 1908, 60, 416—435).—A typical specimen of meteoric iron contains three structure elements: (1) bars of kamacite, formed of hexahedral crystals containing about 6% of nickel; (2) taenite, the crystals of which contain about 33% of nickel; (3) plessite, a mixture of taenite and kamacite. From this structure it would appear that there is a break in the solubility of nickel in iron from 6 to 33% of nickel, but these metals form a continuous series of mixed crystals under ordinary conditions. The authors attempt to account for the differences in the structure of ordinary nickel-iron ores and meteoric nickel-iron of the same composition.

Osmond and Cartaud (Abstr., 1904, ii, 135) have suggested a hypothetical diagram for meteoric iron, according to which the latter is more stable than ordinary nickel-iron alloys. The authors now show, however, that when meteoric iron is heated without access of air, the kamacite first changes into granular crystals, and then the taenite begins to disappear, doubtless owing to the diffusion of the nickel into the altered kamacite. The change in the γ field is slow at 700°, but rapid at 1400°. The change in question takes place even in the α field; after heating meteoric iron for two hundred hours at 420°, granulation of the kamacite is observed, although not with the same certainty as at higher temperatures. It is shown indirectly, however, that the change must take place, and hence that meteoric nickel-iron is unstable at the ordinary temperature.

In order to find whether heated meteoric iron corresponds in properties with ordinary nickel-iron alloys, the magnetic properties of the two substances have been compared. When heated, meteoric iron loses its magnetic properties at about the same temperature as the ordinary alloy of the same composition, but as different pieces of meteoric iron from the same large piece not previously heated lose their magnetic properties at very different temperatures, this result is not conclusive.

Attempts to prepare meteoric iron artificially, or to account for its structure, did not lead to any definite result. It is probable that the iron in kamacite has not crystallised at first in the ordinary (γ) form.

The paper is illustrated with 16 photomicrographs. G. S.

Physiological Chemistry.

Ionic Equilibrium in the Animal Organism. II. The Influence of Carbon Dioxide on the Division of Electrolytes between the Blood-corpuscles and Plasma. KARL SPIRO and LAWRENCE J. HENDERSON (*Biochem. Zeitsch.*, 1908, 15, 114—122).—The explanation of Zuntz's observation that the passage of carbon dioxide into blood increases the alkalinity of the plasma, as determined by titration, has been ascribed to the selective action of the living membrane. The phenomenon can, however, be explained as a purely physico-chemical process. If a dialysed globulin solution is mixed with sodium hydrogen carbonate, a solution of the hydrogen carbonate placed in a dialyser inside the former solution, and carbon dioxide be led into both liquids, the alkalinity of the inner liquid increases. This can be explained by assuming that the following reaction takes place: Na-globulin + $H_2CO_3 = NaHCO_3$ + H-globulin. This increase of sodium salt increases the osmotic pressure of the inner liquid, to compensate for which, water passes out from inside and the carbonate passes to the inside, and thus increases the alkalinity. In the case of blood, a similar reaction takes place between the proteins and carbon dioxide when the latter is passed through. In the corpuscles, the protein content is higher than in the plasma, and a reaction then takes place between potassium phosphate and carbonic acid, leading to the formation of potassium monophosphate and potassium hydrogen carbonate. As a result, the osmotic pressure of the corpuscles becomes greater than that of the serum. Water will therefore have a tendency to pass from the corpuscles to the plasma, and as the cell walls are not permeable to the cations, the system will be "neutralised" by a wandering of anions, chlorine ions passing into the cells and OH^+ and $^-HCO_3$ ions into the plasma. A plasma will therefore be obtained with smaller chlorine content, and greater alkalinity. S. B. S.

Coagulation of Blood. JOHN MELLANBY (*J. Physiol.*, 1908, **38**, 28—112).—Many of the experiments recorded do not support Morawitz's views on the causes of blood-coagulation. Fibrinogen is always associated with prothrombin, and therefore solutions of this substance may be coagulated by kinase and calcium chloride, or by fibrin-ferment. The residual fluid after coagulation contains fibrin-ferment generated from the prothrombin by kinase and calcium chloride; if, however, fibrin-ferment is used as the coagulant, the residual fluid contains prothrombin, but no ferment. The action of calcium is considered to be specific. Salts which inhibit coagulation may precipitate calcium salts, and those which do not precipitate calcium salts may restrain coagulation by holding fibrin in solution, or by depressing the action of calcium and kinase on prothrombin. Plasma and serum contain a large amount of anti-fibrin ferment, but not an anti-kinase; the former is very susceptible to the action of alcohol. Serum usually contains no prothrombin. The activity of Schmidt's fibrin-ferment depends mainly on the presence of kinase and calcium salts in it. Gamgee's ferment solution is one of fibrin-ferment dissolved out by sodium chloride solution from the fibrin which had adsorbed it. Serum-globulin (in the author's sense) is probably derived from the decomposition of fibrinogen under the influence of fibrin-ferment. Serous fluids contain the same substances, but in smaller quantity than the bird's plasma which was employed in most of the present experiments; they therefore coagulate on the addition either of kinase (prepared from testis) or of fibrin-ferment. W. D. H.

Hæmagglutination and Hæmolysis. M. VON EISLER (*Centr. Bakt. Par.*, 1909, 48, ii, 679—681).—Polemical against von Liebermann; the views put forward by this author (Abstr., 1908, ii, 865) are different from those originally propounded by him, but very similar to those of Landsteiner. G. B.

Seromucoid. HUBERT W. BYWATERS (*Biochem. Zeitsch.*, 1909, 15, 322—343).—Blood was coagulated in slightly acid solution by means of steam. The filtrate from the coagulum was concentrated, and the solution thereby obtained submitted to dialysis. It was then filtered, and, after further concentration, acidified with acetic acid and thrown into three times the volume of alcohol. The crude seromucoid obtained in this way is pigmented, and the author describes a method of purification by means of sulphur dioxide. In properties, seromucoid is similar to ovomucoid, but differs from the latter by the intensity with which it gives Hopkins and Coles' glyoxylic acid reaction and by the fact that no scission of sulphur takes place when treated with concentrated alkali hydroxide. It gives most of the other characteristic protein reactions. It contains 47·6% C, 6·8% H, 11·6% N, and 1·75% S. There is 25% carbohydrate in the molecule; this was isolated as a hydrolysis product in the form of glycosamine. The quantity of seromucoid in the blood is small; a method is described for its quantitative estimation; it increases after a meal rich in carbohydrates—in the case of dogs from about 0·3 to 0·9 gram per litre of blood. In spite of its small quantity, the carbohydrate it contains accounts for about 10% of the total circulating in the blood, and the results obtained justify Pavy's hypothesis that, after carbohydrate ingestion, a part enters the circulation in combination with proteins. Seromucoid was also isolated from the mucous membrane of the intestine. S. B. S.

The So-called "Albumose" in Normal Blood. HUBERT W. BYWATERS (*Biochem. Zeitsch.*, 1909, 15, 344—349).—The author criticises the methods by which previous observers have arrived at the conclusion that albumoses exist in the blood. He concludes that albumoses are absent, and that what has been regarded as albumose is in reality seromucoid. S. B. S.

Prolonged Existence of Adrenaline in Blood. D. E. JACKSON (*Amer. J. Physiol.*, 1909, 23, 226—245).—If the blood of a dog poisoned with adrenaline is injected into another or the same animal, it produces a rise of blood-pressure, provided the rise of pressure in the first dog still persists. But if the blood-pressure in the first dog has regained its normal level, which is usually in about a minute after the injection, the blood of that dog will no longer produce a rise of pressure when injected into a second animal. W. D. H.

The Effect on Blood-Pressure of *l*-, *d*-, and *dl*-Suprarenine (Adrenaline). EMIL ABDERHALDEN and FRANZ MÜLLER. **The Resolution of *dl*-Suprarenine into its Components.** FRANZ FLÄCHER (*Zeitsch. physiol. Chem.*, 1908, 58, 185—188, 189—194).—In the first paper, Cushny's statement that *l*-adrenaline has a powerful effect on blood-pressure, that *d*-adrenaline has a feeble effect, and that *dl*-adrenaline has an intermediate effect, is confirmed. In the second paper, the methods are described for the resolution of synthetic *dl*-adrenaline into its optically active components. The methods used consisted in the growth of the mould *Penicillium glaucum*, and in the fractional precipitation of salts. Under the latter head, the tartrates gave the best results. The naturally-occurring *l*-adrenaline gives a crystallisable tartrate. The rotatory powers of the two substances are $[\alpha]_D^{19\cdot6}$ $-51\cdot40°$ and $[\alpha]_D^{19\cdot8}$ $+51\cdot88°$ respectively. W. D. H.

Influence of Quinine on Phagocytosis. TH. GRÜNSPAN (*Centr. Bakt. Par.*, 1908, i, **48**, 444—450).—Weak (less than 0·002%) solutions of quinine have no appreciable influence on phagocytosis *in vivo*; a 0·002% solution increases it, and a 0·1% solution diminishes it. Egg-albumin leads to no increase of phagocytic activity. The intracellular *Staphylococci* appear to be living as judged by their staining reactions. Further work is in progress, as some of the results are regarded as questionable. W. D. H.

Phagocytosis. HEINRICH BECHHOLD (*Chem. Zentr.*, 1908, ii, 1269—1270; from *Münch. med. Woch.*, 1908, **55**, 1777—1798).—The inhibiting action of sodium hydroxide on the phenomenon is lessened by the presence of serum, and still more so by the unaltered blood. Relatively large quantities of lactic acid do not act in this way, even although they produce microscopic alterations of the phagocytes; oxygen and carbon dioxide have no effect, and carbon monoxide has no inhibitory effect. Various colloidal materials were investigated, but they were unable to influence phagocytosis as serum does; the colloidal properties of serum *per se* therefore play no part in the phenomenon. The action of pepsin and pancreatin is stimulated by lactic acid. W. D. H.

Salivary Secretion. IV. Influence of Non-electrolytes. A. JAPPELLI (*Zeitsch. Biol.*, 1908, **51**, 435—459).—Strongly hypertonic solutions of non-electrolytes injected into the blood-stream raise the osmotic pressure of the blood, and also, after a short time, increase the concentration of the electrolytes in that fluid. The organism appears to have the power to maintain the osmotic pressure, and also the proportion between electrolytes and non-electrolytes, at a constant level. The physico-chemical properties of the submaxillary saliva obtained by stimulation of the chorda tympani nerve appear to be independent of the osmotic concentration of the blood, but they are influenced by such electrolytes and non-electrolytes as are permeable through the secreting cells. Dextrose is not permeable, sucrose and lactose only slightly so; these substances hardly alter the saliva at all, although, owing to the greater amount of salts which pass into the blood from the tissues when they are present, they do so indirectly, leading to the production of a saliva rich in salt. An excess of sodium ions in the blood, however, inhibits salivary activity. W. D. H.

Action of Peroxides on the Digestive Organs. TOGAMI (*Chem. Zentr.*, 1908, ii, 1275; from *Berl. klin. Woch.*, 1908, 45, 1528—1532).—The three substances investigated, hydrogen peroxide, magnesium peroxide, and sodium percarbonate, favour gastric secretion.

Hydrogen peroxide (0·1 to 1%) has no effect on the action of ptyalin, pepsin, trypsin, or amylopsin. The other two substances have also no effect, but magnesium chloride favours the action of diastatic ferments, in virtue of the chlorine ion.

Concentrated solutions of hydrogen peroxide produce profuse secretion of mucus, but dilute solutions have no effect on the gastric mucous membrane. W. D. H.

Action of Hydrochloric Acid on the Secretion of Ferments of the Stomach and Pancreas. R. EHRMANN and R. LEDERER (*Chem. Zentr.*, 1908, ii, 1274; from *Berl. klin. Woch.*, 1908, 45, 1450—1452).—In opposition to the statements of earlier investigators, the administration of hydrochloric acid either with or after a test meal produces no increase in the secretion of pepsin. The amount of trypsin secreted by the pancreas is also lessened, and Pawloff's view that hydrochloric acid acts as a specific stimulus for pancreatic secretion is regarded as incorrect. W. D. H.

The Influence of Acids on the Calcium Metabolism of Herbivora. E. GRANSTRÖM (*Zeitsch. physiol. Chem.*, 1908, 58, 195—213).—Rabbits were fed on various diets (cream, wheat), and hydrochloric acid or phosphoric acid added to the food. The effect on calcium excretion in urine and fæces was investigated; both during inanition and after feeding, the calcium in the urine is increased by acid; the amount in the fæces falls except in two cases of phosphoric acid feeding, but the influence of this acid on the fæces is far from clear. Suggestions are made regarding the therapeutic uses of acids in man. W. D. H.

Carbohydrate Metabolism. JOHAN E. JOHANSSON (*Chem. Zentr.*, 1908, ii, 1373; from *Scand. Arch. Physiol.*, 1908, 21, 1—34).—In men, carbohydrate food produces an increase in the output of carbon dioxide, but the amount varies considerably; in doses beyond 150 grams no further increase occurs. Lævulose causes twice as great an increase in carbon dioxide excretion as the same amount of dextrose. Conditions affecting the output which were investigated are (1) previous state of hunger or not; this largely depends on the amount of glycogen storage; and (2) adiabetic condition: here the results are very inconstant. W. D. H.

Rôle of Inorganic Phosphorus in Nutrition. EDWIN B. HART, ELMER V. MCCOLLUM, and J. G. FULLER (*Amer. J. Physiol.*, 1909, 23 246—277).—A number of young pigs were fed on normal diets, on diets containing a minimal amount of phosphates, and on diets containing an excess of these salts. In some experiments, nuclein, lecithin, and phytin were used, but these did not give any better results than inorganic phosphates. A low phosphorus intake is

prejudicial to growth; increase of phosphorus chiefly leads to skeletal growth. There is no evidence of the synthesis of nuclein and other organic phosphorus compounds from inorganic phosphates.
W. D. H.

Changes of Phosphatic Nutrients in the Human Body. E. Koch (*Bied. Zentr.*, 1908, **37**, 858; from *St. Petersburg Med. Woch.*, 1906, 400—402).—In general, inorganic and non-protein phosphorus is not utilised. It is possible, however, that inorganic phosphorus may be utilised if organic phosphorus is excluded from food for a long time.
N. H. J. M.

The Importance of Chlorides in the Life Processes of the Organism. Hermann Friedrich Grünwald (*Zentr. physiol.*, 1908, **22**, No. 16, reprint).—Rabbits were fed on a chlorine-free diet, and then excreted urine which was almost chlorine-free. After administration of diuretin, however, large quantities, 1 gram or more, of sodium chloride were excreted. After four or five doses, the animals exhibited characteristic symptoms of poisoning—weakness, shivering, paresis of the hind limbs, and gradually increasing paralysis, terminating in death in four or five days. The chlorine in the blood sank to a half or even a third of the normal, and in the latter stages of the poisoning, re-administration of chlorine was ineffective in saving the animal. Control animals which had received 1 gram of sodium chloride with the diuretin kept perfectly healthy. The toxic symptoms are therefore due to loss of chlorine, to which von Wyss has ascribed the effects of sodium bromide poisoning, which produces similar symptoms.
S. B. S.

Influence of High Body-temperature on the Decomposition of Sugar in the Animal Body. Hermann Hohlweg and F. Voit (*Zeitsch. Biol.*, 1908, **51**, 491—510).—An elevation of the body-temperature to over 40° by artificial means (warm chamber) leads to an increase in the metabolism of protein, and an increased excretion of nitrogen. This may be lessened or prevented if a sufficient amount of carbohydrate is also administered. Respiratory ventilation is enormously increased, and the excess of combustion falls on the sugar. This occurs also if the sugar is given subcutaneously, and even if sugars (such as sucrose) which are burnt with difficulty under normal conditions are chosen.
W. H. D.

Chemistry of the Brain. A. Rielánder (*Chem. Zentr.*, 1908, ii, 1371; from *Zentr. Physiol.*, 1908, **22**, 377—380).—The basic constituents precipitable by phosphotungstic acid were investigated after hydrolysis by hydrochloric acid. Histidine, arginine, lysine, and choline were obtained; also bases with a heavier molecule than choline.
W. H. D.

Chemico-physical Investigations on the Crystalline Lens. Filippo Bottazzi and Noè Scalinci (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 566—571. Compare this vol., ii, 71).—When the crystalline lens of a dog or rabbit is suspended in dry air, it loses in weight rapidly for four to six hours and then slowly. Notwithstanding the great loss in weight, which amounts to 30·42—49·25% in four hours, the lens does not become opaque, but only wrinkles, so that the opacity of the lens is not due to desiccation alone. When the desiccated lens is immersed in water vapour, it increases in weight very slowly, the original weight of the lens not being attained even after eighty to ninety hours; in some cases, a slight loss in weight occurs during the first few hours of immersion in water vapour. When the desiccated lens is immersed in water, the increase in weight is rapid during the first two hours, after which time the water is only taken up very gradually. T. H. P.

Physiology of Glands. X. The Liver in Different Nutritive Conditions. Leon Asher and Paul Boehm (*Zeitsch. Biol.*, 1908, **51**, 409—434).—Feeding on protein, proteoses, and amino-acids (alanine and aspartic acid) increases the size of the liver cells; the most marked effect was obtained with proteoses. Feeding with fat causes the appearance of fat globules in the cells. Feeding with the proteins, and especially with proteoses, leads, not only to an increase in the size of the cells, but to appearances which are figured, showing they have been stimulated to activity. Alanine and aspartic acid do not seem to act as stimuli in the same way. The view that proteoses are absorbed in part as such is supported. W. D. H.

Salts of Muscle. Fumihiko Urano (*Zeitsch. Biol.*, 1908, **51**, 483—490. Compare Abstr., 1907, ii, 978).—Some analytical figures are given of the total ash and proportion of sodium and potassium in the frog's sartorius before and after washing with sugar solution; this method gives the proportion of salts in the muscles themselves as distinguished from that due to the adherent blood and lymph. A discussion of Overton's views on the osmotic properties of muscle is also given. W. D. H.

Physiological Function of the Arborescent Glands of the Female Generative Apparatus in the Cockroach. L. Bordas (*Compt. rend.*, 1908, **147**, 1495—1497).—The larger of the above glands secretes a milky fluid containing large numbers of minute octahedra of calcium carbonate, which serve to form the walls of the ootheca. G. B.

Protein Bases of the Sperm and Ovaries of the Tunny Fish and their Products of Hydrolysis. Serafino Dezani (*Giorn. R. Accad. Med. Torino*, 1908, **14**, reprint).—The dried sperm of the tunny fish, after removal of the fat, was found to contain 15·87% of nitrogen, of which 20—22% is dissolved by 2% sulphuric acid in the form of a base answering to the reactions of that isolated by Ulpiani (Abstr., 1903, i, 215). On hydrolysing the base, 49·74% of the nitrogen present was accounted for as follows: 6·79% as ammonia, 3·86% as histidine, 37·02% as arginine, and 2·07% as lysine. The composition of the base present in the sperm of the tunny fish hence differs from the mean composition of the protamines in its small proportion of arginine and its large proportion of ammonia. Excepting as regards the arginine, which is always present to the extent of less than 30% in the histones, the base resembles in composition rather the latter than the protamines.

The sperm also contains a nucleic acid, which was obtained as a gelatinous, white mass, turning brownish-yellow on drying in a vacuum, and containing N 14·10% and P 3·10%; this proportion of phosphorus is lower than in any other nucleic acid known.

The dried ovaries of the tunny fish, after removal of the fat, contained 13·65% of nitrogen. Dilute sulphuric acid dissolved 4·46% of the total nitrogen in the form of a *base*, which was obtained as an amorphous, white powder, becoming oily in the air. The base dissolves sparingly in cold water and more readily in hot water, especially if acidified with sulphuric acid; it gives the biuret reaction, and Millon's reaction after the lapse of some time, and is precipitated by concentrated ammonia, picric acid, phosphotungstic acid, and platinum chloride solutions. 16·71% of its nitrogen is present as basic nitrogen, 2·23% as histidine, 0·95% as arginine, and 13·53% as lysine. The molecule of this base has a more complex composition than that of the base present in the sperm, a fact in accord with Kossel's hypothesis, according to which the male sexual cells, with their purely fecundating function, contain the more simple proteins, whilst the female cells, which have to supply nutriment to the new individuals, contain more complex protein substances.

The ovaries contain a nucleic acid, which was separated as a white powder, slightly soluble in hot water, giving an acid solution, with which lead acetate or copper acetate gives an abundant precipitate. The acid contains 13·31% of nitrogen and 9·36% of phosphorus, and is hence a true nucleic acid. T. H. P.

Influence of Sugars on the Secretion of Milk. GIOVANNI PIANTONI (*Chem. Zentr.*, 1908, ii, 1784—1785; from *Arch. Farm. sper.*, 1908, 7, 329—336).—The subcutaneous injection of small quantities of mono- and di-saccharides in a goat produced an increase in the amount of milk secreted without altering its composition. Larger quantities lessened the secretion and the amount of sugar and fat in it, causing also polyuria and the passage of lactose into the urine; this was intensified by repeating the injection daily. Polysaccharides do not have this action. W. D. H.

The Variability of Milk. The Influence of the Addition of Various Salts to Fodder on the Composition and Quantity of the Milk. GEORG VON WENDT (*Chem. Zentr.*, 1908, ii, 1881; from *Skand. Arch. Physiol.*, 1908, 21, 89—145).—Sodium chloride, chalk, sodium phosphate, magnesium bromide, and calcium glycerophosphate when added to fodder do not influence in any definite way the composition of milk. Calcium hydrogen phosphate often increases the quantity of milk, and generally, to a slight extent, the calcium. The variability in the composition of the milk of cows of different breeds and in different periods of lactation is generally about the same. The protein content as lactation proceeds, in contrast to the other constituents, does not diminsh. The phosphorus, nitrogen, and caseinogen contents are the least variable; then come calcium, fat, and lactose; then chlorine, whilst potassium and albumin are the most variable constituents. S. B. S.

Ionic Equilibrium in the Animal Organism. I. The Equilibrium of Acids and Bases in the Urine. LAWRENCE J. HENDERSON and KARL SPIRO (*Biochem. Zeitsch.*, 1908, 15, 105—113).—The ionisation constant of the two acids, β-hydroxybutyric acid and acetoacetic acid, which occur under pathological conditions in the urine, was determined. This was done by ascertaining the relative amount of salt and free acid which was present when a certain tint of an indicator was attained, and comparing it with the amount of free acid and salt present in another acid of which the ionisation constant is known when it gives under the same conditions the same tint. From the equation $(H)^+ = C(HA)/NaA$, where C = ionisation constant divided by the grade of dissociation of the salt, and HA and NaA the quantities of acid and salt present, it is possible to calculate the relative quantities of acid and salt present with different hydrogen ions. These concentrations in urine and blood have been determined under various normal and pathological conditions. As a result it was shown that in blood, even in acidosis, all, or almost all, the hydroxybutyric acid is combined as salt, whereas in urine a considerable quantity is free. The acidity of the urine prevents a large loss of alkali from the body of carnivora, and the kidneys possess the capacity of holding back about half the alkali when it exists in the form of salts of those acids which occur in diabetes. S. B. S.

The Physiological Basis of Radium Emanation Therapeutics. F. NAGELSCHMIDT and F. L. KOHLRAUSCH (*Biochem. Zeitsch.*, 1908, 15, 123—163).—The radioactivity of urine and fæces of patients after ingestion of radioactive solutions was determined, also that of the liver, bile, and blood of rabbits. The following conclusions were arrived at: The radium emanation is a gas, which can be resorbed by the lungs, stomach, and alimentary canal, but not under ordinary conditions by the skin. The greatest part of this gas leaves the system within a relatively short space of time, chiefly in the expired air; a small quantity can be detected in the fæces, and also minute traces in the liver and bile, probably existing here as residual activity. The blood showed no radioactivity, but it is possible that the gas is evolved from this fluid only in a vacuum. The therapeutic significance of these results is discussed. S. B. S.

Elimination of Radium Bromide [in the Organism]. A. JABOIN and BEAUDOIN (*J. Pharm. Chim.*, 1909, [vi], 29, 15—23).—The elimination of radium by the animal organism was studied; 0·05 mg. of radium bromide given in solution to a rabbit by the mouth was wholly eliminated in four days. G. B.

Lecithin, Choline, and Formic Acid. GIUSEPPE FRANCHINI (*Chem. Zentr.*, 1908, ii, 1785; from *Arch. Farm. sper.*, 1908, 7, 371—399).—In rabbits fed on lecithin, the amount of this substance increases in the liver and muscles, but not in the brain; this goes on for two weeks after the administration of lecithin ceases. Small quantities of glycero-phosphoric acid pass into the urine, also formic acid, but not choline. In the fæces, the amount of lecithin increases; glycerophosphoric acid increases in the liver and muscles. W. D. H.

Elimination of Nitrogen after the Administration of Glycine, Asparagine, and Glycyl-glycine Anhydride. Phœbus A. Levene and P. A. Kohn (*Amer. J. Physiol.*, 1909, 23, 324—343).—This is a contribution to the attempts now being made to determine the *rôle* played by individual cleavage products of the protein molecule. If glycine is given, the increase of excreted nitrogen begins earlier than when protein is administered; all the glycine nitrogen is removed as urea within twenty-four hours. Asparagine more nearly approaches protein in its behaviour, where nitrogen retention may last seventy-two hours. Asparagine also is not so rapidly absorbed as glycine. On the hypothesis that the slow excretion was due to the $CO\cdot NH_2$ group in asparagine, glycyl-glycine anhydride, which contains two $CO\cdot NH$ groups, should be eliminated more slowly still; the experiment was frustrated by the death of the dog, but there was no evidence that there was any change into glycine or urea. W. D. H.

The Effect of Muscular Work on the Excretion of Endogenous Purines. Ernest L. Kennaway (*J. Physiol.*, 1908, 38, 1—27).—During unaccustomed muscular work, the output of uric acid is lessened, whilst that of purine bases is increased, the total output of purine substances being about normal. A greatly increased output of uric acid follows the work. If the work is repeated, the changes noted show a progressive diminution, but they reappear when another kind of muscular exercise is taken up. The increase in purine bases is attributed to defective oxidation, but is not modified by inhalation of oxygen. The output of these bases exhibits diurnal variations similar to, but less marked than, those which occur in connexion with uric acid. The amount of the latter tends to vary inversely, and that of the bases directly, with the volume of the urine. The experiments are considered to support Leathes' contention that muscular work leads to an increased formation of uric acid. W. D. H.

The Purine Substances Normally Excreted in Man (when neither Tea nor Coffee have been taken). The late Martin Krüger (*Biochem. Zeitsch.*, 1909, 15, 361—364).—In the urine of a patient who entirely abstained from tea and coffee, the three known methyl derivatives of xanthine usually found in urine, *l*-methylxanthine, heteroxanthine, and paraxanthine, were absent. Guanine was also absent, but xanthine, adenine, and epiguanine were present. Hypoxanthine was absent, and this fact is accounted for by the circumstance that a modified method of isolating the bases was employed, which is described in detail, in which a change of adenine into hypoxanthine does not take place. The results account for the origin of the methylated purine derivatives in urine. S. B. S.

The Excretion and Detection of Atoxyl in the Urine. Georg Lockemann and Martin Paucke (*Chem. Zentr.*, 1908, ii, 1542—1543; from *Deutsch. med. Woch.*, 1908, 34, No. 34).—Gadamer's statement (*Apoth. Zeit.*, 22, 566) that atoxyl is not decomposed by hydrogen sulphide is only correct in a limited degree. If the gas is passed through the heated solution acidified with hydrochloric acid, arsenic is precipitated quantitatively. In the presence of strong hydrochloric acid at 0°, hydrogen sulphide also produces a precipitate, which is probably *p*-aminophenylarsenic sulphide, $NH_2\cdot C_6H_4\cdot AsS_2$, or a similar compound. Also in neutral hot solutions, hydrogen sulphide causes a precipitate. If the atoxyl compound is warmed with sulphur dioxide until all the latter is driven off, hydrogen sulphide then causes a yellow precipitate at the ordinary temperature.

Atoxyl preparations are very inconstant in composition; this is not only due to variations in water of crystallisation, but to other compounds mixed with the atoxyl. Atoxyl can be detected by Ehrlich and Bertheim's reaction (Abstr., 1907, i, 812) either in water or in urine. In water 1 mg. in 100 c.c. can be detected; the delicacy of the test in urine is less.

After subcutaneous injection, atoxyl is rapidly excreted in the urine almost wholly unchanged. If the injections are repeated, traces are found for a week afterwards; a small amount of cleavage occurs in the body, as shown by the presence of "free" arsenic in traces in the urine. Later, a certain amount is taken up and bound in the organism, and finally excreted with keratin. W. D. H.

The Diazo-reaction of Normal Urine. R. Engeland (*Chem. Zentr.*, 1908, ii, 1273—1274; from *Münch. med. Woch.*, 1908, 55, 1643—1645).—The statement of Penzoldt and Petri (*Berl. klin. Woch.*, 1883; *Zeitsch. klin. Med.*, 1884) that normal urine gives Ehrlich's diazo-reaction is confirmed. It is attributed to substances, such as histidine, which contain an imino-azo-nucleus, and the absence of the reaction in many normal urines is attributed to the presence of such substances as creatinine, which unite with imino-azo-compounds. In certain pathological conditions, the excretion of the last-named substances is increased. W. D. H.

A Simple Apparatus for the Cryoscopy of Urine. Erwin Rupp (*Chem. Zentr.*, 1908, ii, 1536—1537; from *Apoth. Zeit.*, 1908, 23, 714).—A form of apparatus suitable for rapid freezing-point estimations with urine. W. D. H.

Hydrochloric Acid Content of Gastric Juice in Anchylostomiasis, with Special Reference to its Relationship to Anæmia and Appetite. Tanzo Yoshida (*Chem. Zentr.*, 1908, ii, 1950; from *Arch. Schiffs. Tropenhyg.*, 1908, 12, 683—697).—The acidity of the gastric juice in Japanese and also in Chinese varies between 45 and 49 degrees of acidity with 0·09—0·17% HCl. In anchylostomiasis these figures remain normal; the juice was rarely subchlorhydric, and still more rarely hyperchlorhydric. The proportion of free hydrogen chloride decreases when anæmia becomes more intense, and the appetite in anchylostomiasis is closely connected with this. G. B.

Experimental Glycosuria. IV. Cause of the Hyperglycæmia Produced by Asphyxia. John J. R. Macleod (*Amer. J. Physiol.*, 1909, 23, 278—302).—Hyperglycæmia lasts some time after asphyxiation. The source of the sugar is the hepatic glycogen, for after extirpation of the liver, hyperglycæmia does not occur. The same is true for the hyperglycæmia produced by curare. The asphyxial (and curare) blood acts directly on the liver cells, for the usual results take place after the hepatic nerves are cut. The substance in the blood considered to be responsible for the action is carbon dioxide, and not loss of oxygen. W. D. H.

Toxicology of Nickel Carbonyl. H. W. Armit (*J. Hygiene*, 1909, 8, 565—600).—The lethal dose of nickel varies according to the animal employed and the method of administration. In the form of nickel carbonyl the conditions for rapid absorption are most favourable, and rabbits die after 3—4 mg. per kilo. of body-weight, and cats after 8·5 mg.

When the gas is breathed, nickel, probably as hydrated basic carbonate, is deposited on the respiratory surface, from which it is taken up by the lymph and blood. It is thus carried to the tissues and deposited there, especially in the brain and adrenals. The histological appearances produced are figured; there is endothelial degeneration, fatty degeneration of the vessel walls and adrenals, and possibly a primary action on the brain cells. Hæmorrhages and other secondary results follow. Nickel is excreted by the kidneys and intestine. Iron-carbonyl produces very similar results, but the fatal dose is larger; cobalt occupies an intermediate position in toxicity. No treatment was found to avert death. W. D. H.

Chemical Constitution and Physiological Activity of Acids. Jacques Loeb (*Biochem. Zeitsch.*, 1909, 15, 254—271).—The physiological activity was determined by ascertaining the strengths of various acids necessary to produce a fertilisation membrane in the eggs of sea-urchins. A number of eggs were immersed in solutions of the acids of varying strengths in sodium chloride solution isotonic with sea-water for definite intervals, then transferred back again to sea-water, and the percentage of eggs which had formed membranes determined in each case. It was found in the case of the fatty monobasic acids that the larger number of carbon atoms they contained the more active were they as membrane producers. The hydroxy-acids were less active than the corresponding unsubstituted acids; the polybasic acids were less active than the monobasic. The mineral acids were also less active than organic acids. The conclusion is drawn that the first action of the acids is to penetrate the cell-membranes, and this is a function of the undissociated acid as a whole, and not of the hydrogen ions. The hydrogen ions appear, however, to inhibit the formation of the membrane, as this takes place only after the eggs are transferred back to sea-water after immersion in the acid. S. B. S.

Is Phenolphthalein Split in the Body? C. Fleig (*Chem. Zentr.*, 1908, ii, 1374; from *Bull. Sci. Pharmacol.*, 1908, 15, 381—384. Compare Abstr., 1908, ii, 313).—Various organs of the dog were perfused with a solution of phenolphthalein. The amount was the same after as before perfusion, except in the case of the kidney, where it was slightly lessened. W. D. H.

Influence of the Asymmetric Carbon Atom in Pharmacology. The Action of *d*-, *r*-, and *l*-Camphor on the Chloral-poisoned Frog's Heart. Juho Hämäläinen (*Chem. Zentr.*, 1908, ii, 1451; from *Skand. Arch. Physiol.*, 1908, 21, 64—79).—The three modifications of camphor have no action on the normal frog's heart. They, however, stimulate the heart's action after this has been lessened by chloral. The action of the three kinds of camphor is pretty equal, but that of the *l*-variety is least. W. D. H.

Chemical Examination and Physiological Action of Nutmeg. Frederick B. Power and Arthur H. Salway (*Amer. J. Pharm.*, 1908, 80, 563—580).—The narcotic action of nutmeg is generally attributed to myristicin, but owing to the fact that the action of nutmeg itself is much more pronounced than that of an equivalent quantity of pure myristicin, it was considered desirable to make a complete investigation in order to ascertain if other substances are present which contribute to the effect.

The essential and expressed oils of nutmeg have already been studied (Trans., 1907, 91, 2037; 1908, 93, 1653). An examination of the "press-cake" has revealed the presence of the following substances which were not identified in either of the oils: dextrose, tannic acid, colouring matters, resins, and a very small quantity of ipuranol (Trans., 1908, 93, 907; Abstr., 1908, ii, 725).

The results of a physiological investigation have shown that the narcotic property of nutmeg is undoubtedly due to myristicin, but have indicated that this substance when associated with the other constituents is in a more favourable condition for absorption than when it is in a pure state. E. G.

Absorption, Excretion, and Destruction of Strophanthine. Robert A. Hatcher (*Amer. J. Physiol.*, 1909, 23, 303—323).—The absorption of strophanthine is rapid even from ligatured loops of intestine. Absorption when the drug is given by the mouth (in man and dog) is, however, comparatively slow, and with small doses, excretion keeps pace with it, so that a large dose has to be given to produce toxic effects. The amount destroyed in the alimentary canal is small. It can, in the rat, be detected subsequently in all the tissues. The oral administration of strophanthine is regarded as therapeutically irrational. W. D. H.

Influence of Iodothyrin, Spermine, and Adrenaline on Oxidation Processes, and on the Toxicity of the Urine. A. J. Juschtschenko (*Biochem. Zeitsch.*, 1909, 15, 365—452).—In mental diseases the toxicity of the urine varies, being sometimes increased, sometimes lessened. It is stated that similar variations are produced in animals, accompanied by changes in gaseous metabolism, by the administration of iodothyrin, spermine, and adrenaline, or by the extirpation, partial or complete, of the glands which produce these substances. W. D. H.

Behaviour of "Bromoglidin" in the Organism. HEINRICH BORUTTAU (*Chem. Zentr.*, 1908, ii, 1742; from *Deutsch. med. Woch.*, 1908, **34**, 1883—1884).—The bromine of "bromoglidin" is secreted in a similar manner to the bromine of potassium bromide, except that secretion is increased. The physiological action appears also to be greater than is indicated by the bromine content.

J. V. E.

Effect of Magnesium on Some of the Toxic Effects of Eserine. DON R. JOSEPH (*Amer. J. Physiol.*, 1909, **23**, 215—225). —Although magnesium salts have no influence on eserine myosis, they have a certain value as an antidote in eserine poisoning; thus they abolish the muscular tremor produced by eserine.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Influence of Aeration on the Formation of Volatile Products in Alcoholic Fermentation. E. KAYSER and A. DEMOLON (*Compt. rend.*, 1909, **148**, 103—105. Compare Abstr., 1907, ii, 714; 1908, i, 317; Trillat, Abstr., 1908, ii, 615).—The authors have compared the action of the champagne yeast No. 3 with that of a yeast (the yeast of bananas No. 221) of a definitely aerobic character on malt extract (containing 15·76% of sugar) with reference to the quantities of volatile acids, esters, aldehydes, and higher alcohols formed. Comparative experiments were made (*a*) in long-necked flasks completely filled in order to avoid contact with the air; (*b*) in shallow vessels two-thirds full and exposing a large surface of liquid to the air. The results are given in tabular form. At the end of one month the quantities of sugar decomposed, and of yeast, volatile acids, esters, and aldehydes formed, by the banana yeast were considerably greater (two to five times) in the shallow vessels than in the flasks, whilst the alcohol content was found to be greater in the unexposed liquid. On the other hand, similar experiments with the champagne yeast showed that exposure to the air had very slight effect on the amounts of sugar decomposed, and yeast formed, decreased those of volatile acids and esters to less than half, doubled the amount of higher alcohols, and enormously increased the proportion of aldehydes.

At the end of six months the effect of exposure to air on the action of the banana yeast is still to increase the amount of sugar decomposed and of yeast formed, although to a smaller extent than after one month, but to largely decrease the amounts of volatile acids and esters. Only traces of aldehyde are found in either exposed or unexposed liquids.

After six months, comparison of the exposed with the unexposed liquids fermented with the champagne yeast shows that the weights of yeast, aldehydes, and higher alcohols are greater, and that of esters is less, in the former than in the latter. Addition of mercuric chloride to the liquid fermented by the champagne yeast in a shallow vessel for six months reduces the amounts of yeast and aldehydes formed, but increases those of esters, ethyl alcohol, and higher alcohols, probably by protecting these from oxidation. E. H.

Influence of Inorganic Salts, particularly of Stannous Chloride, on Fermentation. G. GIMEL (*Compt. rend.*, 1908, **147**, 1324—1326).—Kayser and Marchand have shown that small traces of manganese favour alcoholic fermentation. The author now finds that the effect of stannous chloride on various species of yeast is even more marked, a culture containing one part in 10,000 producing 4% more alcohol than the control. G. B.

Denitrification. MASANIELLO CINGOLANI (*Chem. Zentr.*, 1908, ii, **19**, 1626; from *Staz. sperim. agrar. ital.*, 1908, **41**, 530—540).—Five grams of fresh fæces (from a calf) were placed in 100 c.c. of a 0·3% solution of sodium nitrate, and two organisms which cause denitrification were isolated. Both were cocci, and they are termed *Bacillus porticensis denitrificans*-α and -*β*. The latter attacks nitrates, reducing them to nitrites, but it has no further action; the former reduces nitrites to ammonia and then to free nitrogen, but has no action on nitrates. Ammonia is said to be an intermediate product; when ammonium nitrate is used in place of sodium nitrate, the reaction is much accelerated. E. J. R.

Sewage Purification. W. MAIR (*J. Hygiene*, 1909, **8**, 609—654).—An experimental discussion of the methods of sewage purification, especially in relation to the part played by bacteria. In the contact beds, a considerable proportion of the organic nitrogen disappears as gas as a result of alternate nitrification and denitrification. The amount of nitrate in the effluent is a direct measure of the degree of aeration to which the sewage has been exposed in the percolating beds. If the nitrate disappears from a contact bed, it is a sign that the bed is being overworked; the denitrifying process being allowed to proceed too far. So long as nitrate is present, cultures of the *Bacillus hyponitrosus* have no putrefactive odour. W. D. H.

Standardisation of Disinfectants. Emulsified Disinfectants. HARRIETTE CHICK and CHARLES J. MARTIN (*J. Hygiene*, 1909, **8**, 654—697, 698—703. Compare Watson, Abstr., 1908, ii, 976).—In any method of standardisation, it is necessary that the tests be carried out under constant conditions of temperature, culture medium, number of bacteria per unit volume, and duration of observation. A logarithmic relation exists between concentration of the disinfectant and velocity of disinfection. In the case of metallic salts, traces of the disinfectant carried over with the test sample must be neutralised by sulphide; in the case of mercuric chloride, an excess of sulphide is necessary to decompose a compound formed between the salt and the substance of the bacterium.

Some disinfectants are more efficient against one species of bacterium, others against another. In the case of spores, metallic salts are most efficient. As a rule, virulent species are more difficult to kill than non-virulent ones. In the process of standardisation, it is therefore necessary to fix on a particular organism in the test. *Bacillus typhosus* is the best to employ, but a non-virulent strain should be selected in order to minimise danger to those engaged in the test.

The presence of 10% of blood-serum reduces the efficiency of 1% of phenol by about 12%. The effect on emulsified disinfectants is somewhat greater. The presence of finely particulate matter affects the germicidal value of emulsified disinfectants containing the higher phenols to a much greater extent than it does solutions of phenol. The removal of an emulsion of the higher phenols by bacteria, by finely divided animal charcoal, by dust, etc., obeys in all cases the same quantitative laws. Finer emulsions are more seriously reduced in value by particulate matter than coarser ones.

The removal of an emulsion of higher phenols by bacteria is in the first instance a process of adsorption; disinfectants of this class possess superior efficiency, because owing to this adsorption the bacteria rapidly become surrounded by the disinfectant in much greater concentration than exists throughout the liquid. W. D. H.

Degradation of Sugar during the Respiratory Process.

P. Boysen Jensen (*Ber. Deut. bot. Ges.*, 1908, 26*a*, 666—667).—Alcoholic fermentation is identical with the intramolecular respiration of seeds, and the latter process is the starting point for normal respiration. In alcoholic fermentation, dihydroxyacetone is formed as an intermediate product; if hydroxylamine hydrochloride is added during fermentation, the oxime is formed in small quantity, and after the end of the fermentation, dihydroxyacetone can be isolated as its phenylmethylosazone. Dihydroxyacetone, prepared by Fenton and Jackson's method, yields, on fermentation, alcohol and carbon dioxide. Zymase consists, therefore, of two separate enzymes: *dextrase* and *dihydroxyacetonase*.

In a glycerol solution of dextrose, the second of these is inhibited, so that dihydroxyacetone is the end product. Dihydroxyacetone is also decomposed by oxydase, yielding carbon dioxide and water, but not alcohol. The fact that oxydase attacks neither sugar nor alcohol leads to the hypothesis that in the normal respiration of plants, dihydroxyacetone is the immediate precursor of the carbon dioxide and water; in intramolecular respiration, that is, in an atmosphere deprived of oxygen, it yields carbon dioxide and alcohol. The process of normal respiration can therefore be imitated by adding oxydase to a fermenting dextrose, the degradation of the latter then taking place as follows: $C_6H_6O_6 \longrightarrow OH{\cdot}CH_2{\cdot}CO{\cdot}CH_2{\cdot}OH \longrightarrow CO_2 + H_2O$.

G. B.

The Rôle of Zymases in the Respiratory Processes of Seed-plants. S. Kostytscheff (*Biochem. Zeitsch.* 1908, 15, 164—195).—It has been shown by various observers that anaerobic respiration of pea-seeds is in all essential respects identical with the process of typical alcoholic fermentation. Experiments were carried out to throw further light on the mechanism of the reaction, by determining the amount of alcohol and carbon dioxide produced by pea-seeds and wheat embryos in the presence and absence of air, and in the presence of sugar, and also in the intermediate products formed from the latter by yeast fermentation. It was shown that the assumption that the alcoholic fermentation of seed-plants is independent of the oxygen respiration will not hold, in that such powerful excitants of alcoholic fermentation as pea-seeds produce, with full aeration, no alcohol. Furthermore, alcohol does not appear to be a normal intermediate product of sugar utilisation, for although pea-seeds will when aerated consume slowly the alcohol previously produced in absence of air, the consumption is not accompanied by an increased output of carbon dioxide. Wheat-seeds and embryos do not possess this capacity for alcohol consumption at all. On the other hand, dextrose causes an increased production of carbon dioxide. Solutions containing the intermediate products of fermentation (produced, for example, by the action of zymase in the presence of phosphates) cause an even larger carbon dioxide output than sugar itself. The greater part of the primary products of the zymase action appear to be immediately oxidised further without production of alcohol. The presence of the latter substance in certain seeds is to be explained on the assumption that these primary products do not all undergo immediate oxidation; in this case they are converted into carbon dioxide and alcohol, which latter must be regarded as a by-product only, of the respiratory processes.

S. B. S.

Phosphorus and the Formation of Amino-acids in Higher Plants. Francesco Scurti (*Chem. Zentr.*, 1908, ii, 16, 1370; from *Staz. sperim. agrar. ital.*, 1908, 41, 456—470).—The non-protein nitrogen compounds in plants are made up of the same substances as are found in germinating seeds and in young seedlings. Phosphorus is known to play an important part in protein formation, and the author considers that it may function in the formation of amino-acids.

E. J. R

Occurrence and Rôle of Zinc in Plants. Maurice Javillier (*Chem. Zentr.*, 1908, ii, 1828; from *Bull. Sci. Pharm.*, 1908, 15, 559—565).—Besides certain well-defined varieties growing on soils which are rich in zinc, most plants contain appreciable quantities of this metal, which is especially found in Conifers. The growth of yeast is favoured by small quantities of zinc, although the optimum concentration of the metal is greater than in the case of *Aspergillus*.

Zinc can also act favourably on the growth of Phanerogams, for example, cereals. G. B.

The Chemical Processes of Ripening. The Ripening of Oranges. Presence of Asparagine and Glutamine in the Juice. Francesco Scurti and G. de Plato (*Chem. Zentr.*, 1908, ii, 16, 1370; from *Staz. sperim. agrar. ital.*, 1908, 41, 435—455).—The authors draw the following conclusions from their experiments: (1) The acidity of oranges is due to citric and malic acids, the quantity of which increases in the earlier stages, but falls off afterwards. In this respect oranges resemble other acid fruits. (2) The sugars present are dextrose, lævulose, and sucrose; the two first steadily increase during ripening, whilst the sucrose decreases. There is more lævulose than dextrose. In sweet and in bitter oranges there is more reducing sugar than sucrose, but not in common Italian oranges. No relationship could be discovered between acidity and the amount of sucrose present. (3) The total nitrogenous matter decreases, but the loss falls entirely on the proteins precipitated by basic lead acetate and not on the other nitrogen compounds, which remain constant in amount. These non-protein compounds consist chiefly of asparagine and glutamine it is significant that these two, which are constantly associated with germination and assimilation, should also be present during ripening. E. J. R.

The First Stages in the Development of Perennial Plants compared with those of Annuals. Gustave André (*Compt. rend.*, 1908, 47, 1485—1487).—During the first two years of the life of a perennial plant, the root is much more developed, relative to the shoot, than is the case in annual plants, and contains a larger proportion of phosphates than the root of the latter. G. B.

Constituents of the Fruit of Rhamnus cathartica. Nicolai A. Waljaschko and N. Krasowsky (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1502—1509).—Discussion of previous work on this subject (see Tschirch and Pedersen, Abstr., 1898, i, 599; Hesse, Abstr., 1900, i, 40; Tschirch and Polacco, Abstr., 1900, i, 681) and of the results obtained by Krasowsky (see following abstract). T. H. P.

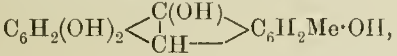
Berries of Rhamnus cathartica and the Methods of Separating the Substances Contained Therein. N. Krasowsky (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1510—1569. Compare Tschirch and Polacco, Abstr., 1900, i, 681).—After describing in detail the methods used for extracting the various constituents from the berries and purifying them, the author discusses separately each of these constituents, which are as follows.

(1) Quercetin, apparently identical with that obtained from quercitrin. (2) Rhamnotin. (3) Xanthorhamnin (compare Tanret and Tanret, Abstr., 1900, i, 185), which is hydrolysed by dilute sulphuric acid, giving rhamnotin, galactose, and rhamnose (2 mols.): $C_{34}H_{42}O_{20} + 3H_2O = C_{15}H_9O_7Me + C_6H_{12}O_6 + 2C_6H_{12}O_5$. The only difference between the product described by Tanret and Tanret (*loc. cit.*) and that obtained

by the author is that the former gives golden-yellow crystals, whilst the latter separates in faintly yellow crystals. (4) Emodin,

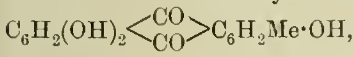
$$C_{15}H_{10}O_5,H_2O,$$

m. p. 254—255°, which is a trihydroxymethylanthraquinone, and closely resembles frangula-emodin (compare Oesterle, Abstr., 1900, i, 304). (5) *Rhamnoxanthin*, $C_{21}H_{20}O_9,H_2O$, which is reduced to methylanthracene by zinc dust in an atmosphere of hydrogen, and readily undergoes transformation into emodin when crystallised repeatedly from alcohol. *Tetra-acetylrhamnoxanthin*, $C_{21}H_{16}O_9Ac_4$, crystallises from acetic acid in microscopic, pale yellow needles, m. p. 146—149°. Rhamnoxanthin is a glucoside, and is resolved into emodin and methylpentose on hydrolysis with dilute hydrochloric acid: $C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5$. (6) *Jesterin*, $C_{26}H_{30}O_{13},\frac{1}{2}H_2O$, m. p. 205—218°, which is a glucoside yielding emodinanthranol, hexose, and pentose on hydrolysis: $C_{26}H_{30}O_{13} + 2H_2O = C_{15}H_{12}O_4 + C_6H_{12}O_6 + C_5H_{10}O_5$. (7) *Rhamnocathartin*, $C_{27}H_{30}O_{14}$, which is hydrolysed by alkali, giving rhamnoxanthin and an unknown hexose, $C_{27}H_{30}O_{14} + H_2O = C_{21}H_{20}O_9 + C_6H_{12}O_6$, and by acid, giving emodin, rhamnose, and hexose, thus: $C_{27}H_{30}O_{14} + 2H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5 + C_6H_{12}O_6$. (8) *Emodinanthranol* (*trihydroxymethylanthranol*),



$$C_6H_2(OH)_2{<}\begin{matrix}C(OH)\\|\\CH\end{matrix}{>}C_6H_2Me\cdot OH,$$

which separates from ethyl acetate in faintly yellow crystals, m. p. 280°; its *tetra-acetyl* derivative, $C_{15}H_8O_4Ac_4$, crystallises from alcohol in pale yellow plates, m. p. 197°. In alkaline solution, emodinanthranol is oxidised by the oxygen of the air, yielding emodin,



$C_6H_2(OH)_2{<}\begin{matrix}CO\\CO\end{matrix}{>}C_6H_2Me\cdot OH$, reduction of which by means of tin and hydrochloric acid yields emodinanthranol. (9) Rhamnonigrin or a mixture of rhamnonigrins, which were not characterised. (10) Succinic acid.

The berries of *Rhamnus cathartica* contain dextrose in the free state, and galactose, rhamnose, and pentose only in the form of glucosides. T. H. P.

Chemistry of the Higher Fungi. II. Polyporus ignarius. JULIUS ZELLNER (*Monatsh*, 1908, 29, 1171—1187. Compare Abstr., 1908, ii, 216).—The constituents of *Polyporus* closely resemble those of *Trametes suaveolens* previously examined (*loc. cit.*), in accordance with the fact that these closely-related fungi are parasitic on the same host (willow). The ash (with much calcium sulphate), ergosterols, fats, resins, soluble proteins and volatile substances, dextrin-like carbohydrates (which are abundantly present), and ferments are all very similar. The constituents of the cell wall, however, are different, and, unlike *Trametes*, *Polyporus* contains mannitol and tannins, but no mycose. G. B.

Presence of Urea in Certain Higher Fungi. A. GORIS and M. MASCRÉ (*Compt. rend.*, 1908, 147, 1488—1489).—Young specimens of *Psalliota campestris* contain urea to the extent of 2·75%, and mature ones, 4·3% of their dry weight (compare Abstr., 1903, ii, 567). G. B.

Some Mannas and Related Products. ALFRED EBERT (*Chem. Zentr.*, 1908, ii, 1874—1875; from *Zeitsch. Allg. Oesterr. Apoth. Ver.*, 1908, **46**, 427—429, 439—440, 447—450, 459—460, 467—470, 479—481, 491—492, 503—504, 515—516, 529—530).—This gives the proximate composition of a number of Persian and Australian mannas. The figures given below are expressed in percentages of the crude materials, except where otherwise stated.

"Trehala," derived from the larval cocoons of a beetle living on the stems and flowering heads of *Echinops persicus*, contains moisture 11·1, ash 2·6, trehalose 17·5, gum (yielding mucic acid on oxidation) 27·1, and tannin and residue 44·5; of the residue, 71% consists of a starch giving a reddish-brown colour with iodine.

"Terendschabin" is exuded from the leaves and thorns of *Alhagi maurorum*; it consists of moisture 5·2, ash 9·4, chlorophyll with some gum 0·5, sucrose 42·0, a gum (yielding oxalic acid on oxidation) 20·3, and residue 32·0.

"Bide-khecht," derived from the leaves of *Salix fragilis*, contains moisture 4·1, ash 25·4, dextrose 17·5, sucrose 50·1, matter soluble in water 13·3, and insoluble matter 19·2. The sample was adulterated with wheat-flour and gypsum.

"Gueze-elefi," from *Quercus vallonia*, contains moisture 7·5, ash 5·4, sucrose 53·2, dextrose 19·0, gum (yielding mucic acid on oxidation) 10·3, and insoluble residue 10·0.

"Schir-Khist," the manna from *Cotoneaster nummularia*, contains moisture 15·9, ash 2·2, dextrose 37·5, sucrose 12·9, gum (yielding mucic acid) 24·2, and insoluble residue 9·5.

"Eucalyptus manna," from *E. Gunnii*, var. *rubida*, contains moisture 9·7, ash 6·8, melitose 68·5, dextrose 20·9, sucrose 2·1, gum (yielding mucic acid) 3·2 and insoluble residue 4·3. A specimen from *E. pulverulenta*, S., consists of melitose 21·4, lævulose 16·2, sucrose 60·0, and insoluble residue 1·0.

Tabasheer, a siliceous deposit from bamboo culms, especially *Bambusa stricta* R., contains sucrose 4·2, gum (yielding mucic acid) 2·6, and inorganic residue about 90 (compare Ince, Abstr., 1897, ii, 278).

T. A. H.

Mode of Combination of Mineral and Organic Acids in Wine. ANTONIO QUARTAROLI (*Bied. Zentr.*, 1908, **37**, 862; from *Staz. sper. agrar. ital.*, 1906, **39**, 993).—The mineral acids of wine are in the form of salts unless present in very large amounts. Addition of mineral acids can be detected by determining the electrical conductivity, which is distinctly increased by adding potassium hydroxide to wine containing neither mineral nor free organic acid. When organic acids have been liberated by addition of mineral acid, the conductivity is diminished by adding potassium hydroxide. Addition of 1 gram of sulphuric acid per litre can be detected in this manner.

N. H. J. M.

Amounts of Nutrients Utilised by Sugar-beet in the First Year, and their Relation to the Amount of Sugar in the Roots. KARL ANDRLÍK and JOSEF URBAN (*Zeitsch. Zuckerind. Böhm*, 1909, **33**, 221—240. Compare Abstr., 1908, ii, 1066).—For a yield of 400 quintals per hectare of roots, it was found that the indispensable amounts of phosphoric acid, nitrogen, and potash were 65·1, 139·8, and 168·6 kilos. respectively. The amount of phosphoric acid is thus approximately the mean of the amounts found by Hoffmann (71·4) and by Willfarth (62·0 kilos.), whilst the amount of nitrogen is lower, and that of potash higher, than those given by Hoffmann and Willfarth; the yield of sugar in Bohemia was, however, also higher than the yields obtained in Germany.

At present the most favourable relations of the different nutrients are $N=2·15$ and $K_2O=2·59$ to 1 part P_2O_5. When, by selection, roots are obtained containing higher amounts of sugar, it will be necessary to ascertain whether these amounts still hold good.

N. H. J. M.

Influence of Some Calcium Compounds on the Manurial Value of Ammonium Sulphate and Calcium Cyanamide. Alexander Stebutt (*Bied. Zentr.*, 1908, **37**, 805—806; from *Fühling's Landw. Zeit.*, 1907, **56**, 669).—Pot experiments in which mustard was grown in loam, containing 0·09% of calcium carbonate, and manured with ammonium sulphate and calcium cyanamide in conjunction with calcium oxide, carbonate, and sulphate respectively. The conclusion is drawn that, under normal conditions, the calcium compounds are without effect on the action of the two nitrogenous manures.

N. H. J. M.

Is Dicyanodiamide Poisonous to Crops? Oscar Loew (*Chem. Zeit.*, 1909, **33**, 21—22. Compare Abstr., 1908, ii, 775).—Pot experiments with barley in garden soil with mineral manures and with $N=0·75$ gram in the form of dicyanodiamide (1 and 2) and as ammonium sulphate (3). The soil of (1) was heated at 100° for one hour. A fourth pot was without nitrogen.

The highest amount of dry matter (43·2 grams) was obtained in the pot which had ammonium sulphate. Dicyanodiamide in heated soil gave the next highest amount (31·3 grams), then the pot which had no nitrogen (24·8 grams), and last, dicyanodiamide in non-sterilised soil. The conclusion is drawn that dicyanodiamide is directly utilised by plants under sterilised conditions, but that in unsterilised soil it is converted by microbes into substances injurious to plants.

N. H. J. M.

Phosphoric Acid with Different Citric Acid Solubility as Manure for Meadows. Hanno Svoboda (*Chem. Zentr.*, 1908, ii, 1893; from *Zeits. Landw. Versuchswes. Oesterr.*, 1908, **11**, 733—774).—Whilst the rapidity of action of phosphate manures depends on a high percentage of phosphoric acid soluble in citric acid, the value of the manure depends mainly on the amount of total phosphoric acid.

N. H. J. M.

The Causes which Determine the Replacement of Potassium of Leucite in Soils. Luigi Bernardini (*Chem. Zentr.*, 1908, ii, **15**, 1285; from *Staz. sperim. agrar. ital.*, 1908, **41**, 304—320).—The leucite used contained when dried at 110°: SiO_2, 56·89; $Al_2O_3+Fe_2O_3$, 24·08; K_2O, 15·63; Na_2O, 1·77; CaO, 1·11; MgO, traces.

The solubility was determined in hydrochloric acid, 5% acetic acid, water, a solution of carbon dioxide in water, and in a number of salt solutions including sodium chloride, nitrate and sulphate, ammonium chloride, nitrate, sulphate and carbonate, calcium chloride, nitrate, sulphate and dihydrogen phosphate, and magnesium chloride, nitrate and sulphate. Sodium and ammonium salts caused a good deal of potassium to go into solution; magnesium and calcium salts, on the other band, had only a slight solvent power. The author considers that double decomposition takes place, the potassium of the leucite being replaced by sodium or ammonium. Ammonia produced in the soil by bacterial processes would therefore react with leucite, forming an insoluble ammonium leucite, whilst at the same time a soluble potassium compound is formed which is available for plants. The ammonia can no longer be washed away by rain, but may still be nitrified.

E. J. R.

Humus-Silicic Acid. HJALMAR VON FEILITZEN (*Bied. Zentr.*, 1908, 37, 793—794; from *Svenska Mosskulturförening Tidskr.*, 1907; and *Wiener landw. Zeit.*, 1907, No. 43).—The manure, which is prepared from peat, has the following composition: water, 10·12; organic matter, 46·13; N, 1·26; K_2O, 2·64; CaO, 6·44; P_2O_5 (*a*) soluble in boiling 24% HCl, 3·33; and (*b*) citrate soluble, 2·55%.

Application of the manure alone (1000 kilos. per hectare) to a poor, sandy soil increased the yield of peas, but was without effect on oats, owing to the deficiency of nitrogen in the soil. When applied in conjunction with other manures, humus-silicic acid gave similar results with peas, and very slightly increased the yield of oats.

N. H. J. M.

Analytical Chemistry.

Simplified Apparatus for Gas Analysis at a High Temperature. ANTOINE DE SAPORTA (*Chem. Zentr.*, 1908, ii, 1377—1378; from *Rev. gen. chim. pure appl.*, 1908, 11, 311—314).—The apparatus consists essentially of a distilling flask, a repeatedly bent delivery tube, a graduated cylinder, and a small trough filled with mercury placed in a larger vessel containing water. In the delivery tube just before it reaches the graduated cylinder and under the surface of the mercury is a small hole. If now, from whatever cause, the evolution of gas ceases, mercury ascends into the delivery tube, and equilibrium is restored, so that absorption can never take place.

L. DE K.

Quantitative Folded Filter Papers. F. HART (*Chem. Zeit.*, 1908, 32, 1228).—The author advocates more general use of folded filter papers for quantitative work where rapid filtration is required; their use is recommended, especially when working with fine quartz sand and colloidal precipitates.

J. V. E.

Pressure-equalising Attachment for Desiccators. Edwin Dowzard (*Amer. J. Pharm.*, 1908, 80, 588).—The following arrangement has been devised in order to obviate the lifting of the lid of a desiccator caused by the expansion of the air when a hot crucible or basin is placed in it, and the subsequent reduction of the pressure on cooling. A calcium chloride U-tube is placed in the lower part of the desiccator, and carries an arm which passes through a perforated rubber stopper in the side of the desiccator. E. G.

Estimation of Halogens in Organic Compounds. C. W. Bacon (*Chem. News*, 1909, 99, 6; *J. Amer. Chem. Soc.*, 1909, 31, 49—52).—The following details are given for successfully carrying out halogen determinations by Stepanoff's method (Abstr., 1905, i, 335) Let *w* represent the number of grams of halogen compound taken (about 0·2) in a dry Kjeldahl flask; it is warmed under a reflux condenser with·156*w* c.c. of, at least, 98% alcohol if the compound contains chlorine, 68*w* c.c. if it contains bromine, or 44*w* c.c. if it contains iodine. The addition of sodium must extend over 30 minutes, the weight of metal required being 19·5*w* grams, 8·5*w* grams, or 5·5*w* grams, according as the substance contains chlorine, bromine, or iodine. When all the sodium is added, the solution is gently boiled for an hour, allowed to cool to 50—60°, diluted freely with water, and acidified with nitric acid. A moderate excess of silver nitrate is added, and, when quite cool, the excess of silver nitrate is estimated volumetrically by Volhard's method. If the halogen involved is chlorine, the precipitate should be filtered off; with bromine or iodine this is not necessary; when copiously diluted with water, the presence of alcohol does not interfere with titration. J. V. E.

Detection and Estimation of Chlorates. Juan Fages Virgili (*Anal. Fis. Quim.*, 1908, 6, 459—476).—Two solutions are recommended as a means of detecting chlorates in the absence of certain oxidising agents (enumerated below): the first, *A*, a solution of 50 grams of aniline hydrochloride in 1000 c.c. of hydrochloric acid, D 1·12; the second, *B*, a solution of 50 grams of the same salt in 1000 c.c. of hydrochloric acid, D 1·14. *B* is used instead of *A* when the solution to be tested is dilute, so that more of the latter has to be used in the test. This is generally carried out by taking 1 drop to 1 c.c. of the solution (or a small fragment to 1 gram of solid) in a test tube, and adding 1 c.c. to 4 c.c. of solution *A*; a chlorate produces an intense blue coloration. This is primarily due to chlorine being liberated and acting on the aniline salt, so that a number of oxidising agents (chlorine, hypochlorites, hypobromites, bromates, iodates, peroxides, chromates, manganates, permanganates, vanadates, and ferricyanides) also produce it; but dilute nitric acid, solutions of nitrates, and nitrites do not give the blue colour, so that the test is very useful for detecting chlorates in many special cases, for example, in nitres, explosives, urine. By means of it, 0·00007 gram of potassium chlorate can readily be detected. In presence of bromides or iodides, the reagent does not give an indication with chlorates or other oxidising agents; in such a case, the haloids have to be first removed by adding silver nitrate in excess, and then sodium chloride to precipitate the excess of silver; the filtered solution is used as just stated.

In the absence of oxidising agents, the solutions *A* and *B* can be used to estimate small quantities of chlorates colorimetrically. Solution *A* is used for quantities of 0·0001 to 0·0022 gram per 5 c.c., and *B* for quantities from 0·0005 to 0·0070. Twenty c.c. of the reagent are then added to 5 c.c. of the solution. For larger quantities of chlorate up to 0·01 gram, 40 c.c. of *B* are added to 10 c.c. of the solution. The colour obtained after twenty minutes is compared with that of a series of solutions containing known quantities of chlorate, and differing from one tube to another by 0·0005 gram for quantities between 0·005 and 0·01 gram, and by 0·00025 for quantities between 0·002 to 0·005 gram. Another method is to make the colour comparison by means of successive dilution until the shades correspond. The results obtained are very good. W. A. D.

Detection of Fluorine in Beer. JULES FLAMAND (*Bull. Soc. chim. Belg.*, 1908, 22, 451—453).—One litre of beer deprived of carbon dioxide by shaking is rendered alkaline by addition of ammonium carbonate and ammonia, a few c.c. of saturated sodium sulphate solution are added, and the liquid is heated to boiling. A 10% solution of barium chloride is added, and, after boiling for ten minutes, the precipitate is allowed to settle; the clear liquid is decanted, and the deposit is collected on a filter, which is then at once placed in a drying oven; the precipitate need not be washed.

When dry it is detached from the filter, transferred to a platinum crucible, and gently ignited. When cold, the crucible is placed in a cold water-bath. A little sulphuric acid is added, and the crucible covered with a paraffin-coated glass plate on which some lines have been engraved. The plate must be kept cool by any suitable arrangement, and the water-bath is then heated to boiling and kept so for an hour. If fluorine is present, the usual etching will be obtained.

L. DE K.

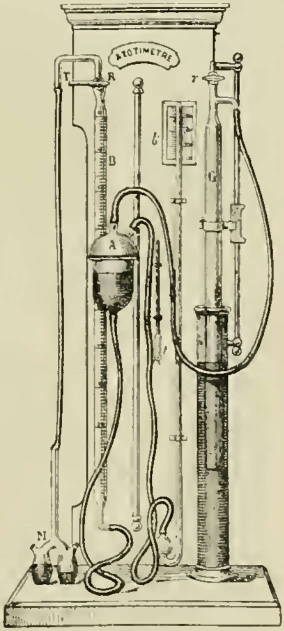
Estimation of "Neutral" Sulphur in Urine. LEO HESS (*Chem. Zentr.*, 1908, ii, 1290; from *Berlin klin. Woch.*, 1908, 45, 1452—1453).—Five hundred c.c. of urine are mixed with 25—50 c.c. of hydrochloric acid and excess of barium chloride, and heated to boiling in a flask fitted with a bulb apparatus containing alkaline pyrogallol; the heating is then continued for six hours on the water-bath. After twenty-four hours, the liquid is filtered, rendered alkaline with sodium hydroxide, and saturated with chlorine. After the lapse of a few hours, the liquid is acidified with hydrochloric acid and boiled. The barium sulphate thus formed represents the "neutral" sulphur. L. DE K.

Estimation of Sulphuric Acid as Barium Sulphate. ERNST RUPPIN (*Chem. Zeit.*, 1908, 33, 17—18).—Barium chloride should be added to the boiling acid solution all at once, and in quantity about twice that actually required. The precipitate should then be boiled

four times in succession with acidified water. Better results are, however, obtained by precipitating the sulphate in presence of sodium hydrogen carbonate (about 0·5 gram to 1 gram of sulphate); the co-precipitated carbonate is then re-dissolved by addition of hydrochloric acid. The barium sulphate thus obtained is, after careful washing, perfectly pure.
L. DE K.

Estimation of Sulphuric Acid in Leather. JOHANNES PAESSLER and ARNOLDI (*Chem. Zentr.*, 1908, ii, 1297; from *Collegium*, 1908, 358—362).—Five grams of the finely-divided sample are placed in a platinum boat and mixed with 5 c.c. of 10% sodium carbonate and 1·5—1·8 grams of cobaltic oxide. If only combined sulphate is to be estimated, no sodium carbonate is used. After drying, the mixture is heated in a slow current of oxygen; the boat is placed either in a wide combustion tube or else in Schopper's electric apparatus.
L. DE K.

Nitrometer [Volumeter] with Barometric Correction. HERMAN (*Bull. Soc. chim. Belg.*, 1908, **22**, 440—444).—The nitrometer, which, however, is suitable for a more extended application, will be readily understood from the figure. The reservoir *A* is filled with a sufficient quantity of water, and the stopcock *R* is turned in such a manner that the interior of the burette *B* is in communication both with the outer air and the mixer *M*. The air-tap *r* of the gasometer should be open. *M*, which contains the substance, and also the reagent needed to liberate the gas, is attached to the burette, and the water level is brought to zero by raising the reservoir. Stopcock *R* is then turned so as to shut off the air, but to still leave the connexion with the burette. At this moment the reaction is started by allowing the contents of *M* to mix; it is seized by the stem and well shaken. The gas evolved displaces the liquid in the burette, and when the water level shows no further alteration, the reservoir is lowered and the levels are restored. The barometric correction is made by reducing the pressure of the gas evolved to 760 mm. *R* is then turned so as to close the upper part of *B*. If the pressure indicated by the barometer exceeds 760°, the bell jar is raised after closing the air-tap *r*. The mercury level falls while the volume of gas in the burette is increasing. If the pressure is less than 760 mm., the reverse happens. In either case the pressure is brought to 760 mm., and this will be the same both in the barometer and the burette, as both are connected with the reservoir. The



thermometer employed has a scale attached to it for correction for temperature and tension of aqueous vapour, but this scale is not shown in the figure. A table is given for correcting the volume of the gas for the temperature of 17°, also for 0°, and in the dry state. To save calculation, the burette is also graduated so as to show the weight in milligrams of the gas. L. DE K.

Estimation of Phosphoric Acid as Ammonium Phosphomolybdate. HENRI PELLET (*Ann. Chim. anal.*, 1908, 14, 7—11).—Chesneau's process (Abstr., 1908, ii, 427) is recommended for the estimation of phosphorus in iron and steel, and for the accurate estimation of very minute quantities of phosphoric acid in general.
L DE K.

Estimation of Phosphoric Acid in Basic Slags by Weighing the "Yellow Precipitate." ZYGMUNT ROMAŃSKI (*Chem. Zeit.*, 1909, 33, 46—47).—Fifteen c.c. of the sulphuric acid solution prepared as usual (= 0·15 gram of the sample) are neutralised with 15% sodium hydroxide solution, using phenolphthalein as indicator. Five c.c. of acid mixture (34 c.c. of sulphuric and nitric acid, D 1·2, up to one litre) are added, and the whole heated to boiling. Fifty c.c. of molybdate solution are added, and, after remaining overnight, the precipitate is collected at the pump on a Neubauer crucible, washed with 1% nitric acid, then with alcohol, and finally with highly volatile light petroleum, D 0·7. After drying at 40°, it is weighed; multiplication by 0·03496 gives the amount of phosphoric anhydride.

When dealing with citrate-soluble acid, 20 c.c. of the solution (= 0·2 gram sample) are mixed with thirty c.c. of the above acid, heated to boiling, and precipitated with fifty c.c. of molybdate solution.

The molybdate solution should be prepared as follows: four litres of nitric acid and 1600 grams of ammonium nitrate are placed in a ten-litre flask, and the temperature is raised to 20°. Six hundred grams of ammonium molybdate are dissolved in 2800 c.c. of hot water, cooled to 30°, and then poured into the acid liquid with constant shaking. When clear, the reagent is filtered and ready for use. L. DE K.

Estimation of Mineral Constituents in Vegetable Substances. L. VUAFLART (*Bull. Assoc. Chim. sucr. dist.*, 1908, 26, 448—455).—Phosphoric acid is generally estimated by burning the substance in the presence of calcium oxide, but even this does not prevent a loss of the acid, particularly in the case of wheat. It is, therefore, advisable to destroy the organic matters by heating the substance in a Kjeldahl flask with sulphuric acid and a globule of mercury, adding afterwards some nitric acid to complete the oxidation; the phosphoric acid is then estimated by the molybdate process. Potassium may be estimated as usual, after destroying the organic matters with sulphuric and nitric acids, but equally accurate results are obtained by moistening the substance with sulphuric acid and subsequent ignition. Chlorine will be retained completely in the ash if the substance is mixed previously with calcium oxide (5 : 2). Sulphur and sulphates may be estimated without loss by boiling the substance with nitric acid, expelling the excess of the latter, neutralising with sodium carbonate, and, finally, heating the dry mass. Manganese is estimated in the ash by the lead peroxide method. Nitrates are best estimated as nitric oxide in the Schloessing apparatus. The author removes interfering matters by adding to the hot aqueous extract treble the volume of alcohol. After a few days, the solution is filtered, and the filtrate concentrated to a few c.c. L. DE K.

Estimation of Silver. FRANZ MAWROW and G. MOLLOW (*Zeitsch. anorg. Chem.*, 1909, 61, 96—99).—On the addition of hypophosphorous acid to a boiling solution of silver nitrate, heating being continued until the liquid is clear, a black precipitate of silver separates, immediately becoming grey; this is collected, washed with 96% alcohol until free from acid (water causes it to pass through the paper), dried, and weighed as silver. The operation is complete in ten to fifteen minutes, and gives accurate results. The presence of organic acids is without influence.

Lead is precipitated by hypophosphorous acid as lead hypophosphite. C. H. D.

Estimation of the Hardness of Water. KLUT (*Chem. Zentr.*, 1908, ii, 1953; from *K. Prüf.-Anst. Wasserversorg. Abwasserbeseit.*, 1908, 10, 75—85).—From a comparison of methods for estimating the hardness of water, it is found that gravimetric methods alone are trustworthy, although for rapidly ascertaining the total hardness of a hard water containing much magnesium, Clark's soap method gives good results. The Wartha-Peeifer-Lunge gravimetric method is not so simple, or so accurate as the soap method. Carbonate hardness is best determined by Lunge's method of titration, using *N*/10 acid and methyl-orange as indicator. The adoption of the terms *carbonate hardness* instead of "temporary hardness," and *mineral acid hardness* for "permanent hardness," is advocated.

J. V. E.

Precipitation of Magnesium as Ammonium Magnesium Phosphate. ERCOLE RAFFA (*Gazzetta*, 1908, 38, ii, 556—566).—The author has made a number of experiments to determine the conditions influencing the precipitation of magnesium as ammonium magnesium phosphate.

The amount of precipitate obtained increases with the proportion of ammonia present, but never reaches the theoretical quantity if the precipitation is carried out in the cold (compare Neubauer, Abstr., 1896, ii, 674). The presence of much ammonia or of ammonium chloride is useless to prevent precipitation of magnesium hydroxide. The only effect of excess of ammonia is to diminish the solubility of the ammonium magnesium phosphate, an advantage which is often counteracted or greatly diminished by the possible formation of more complex phosphates, such as $Mg(NH_4)_4(PO_4)_2$.

For the gravimetric estimation of magnesium, the following procedure is recommended. The precipitant consists of an *N*/2 solution of ammonium disodium phosphate, obtained by mixing equivalent quantities of ammonia and of the phosphate; the magnesium solution should contain 0·3—0·5% of magnesium. To 20—25 c.c. of the reagent, 10 c.c. of the magnesium solution are rapidly added, the mixture being shaken. After depositing, the precipitate is filtered off on to a tared filter or Gooch crucible, washed with 2·5% ammonia solution until all the chlorine is removed, and converted into pyrophosphate in the ordinary way.

The volumetric estimation of magnesium requires: (1) a standard solution of uranyl acetate, 1 c.c. = 0·005 gram P_2O_5 = 0·0067 gram PO_4; (2) a *N*/2 ammonium disodium phosphate solution (*vide supra*), titrated at the time of using with the uranyl acetate solution. The magnesium solution should contain 0·3—0·5% of magnesium, and should be perfectly neutral. Into a cylinder having a ground-in stopper, and without constriction, are placed 40 c.c. of the ammonium disodium phosphate solution and 10 c.c. of the magnesium solution; the mixture is well shaken, allowed to settle, and filtered through a dry filter. An aliquot part of the filtrate is mixed with 1—2 c.c. of acetic acid, and the residual phosphate estimated by titration with the uranyl acetate solution. T. H. P.

Estimation of Zinc with Ferrocyanide. Erwin Rupp (*Chem. Zeit.*, 1909, 23, 3—4).—A solution is prepared containing 4—5% of potassium ferrocyanide. Ten c.c. of this are diluted to 50 c.c., 6 grams of potassium sodium tartrate are added, and then an excess of *N*/10 iodine. After one hour, the liquid is titrated as usual with *N*/10 sodium thiosulphate. One c.c. of *N*/10 iodine = 0·0212 gram of ferrocyanogen.

When titrating zinc, a suitable volume of the neutralised solution is added to a judicious excess of the ferrocyanide solution diluted to 50—100 c.c., and containing 5 grams of sodium potassium tartrate. After twenty to thirty minutes, the excess of ferrocyanogen is titrated as directed. The iodine is without action on the precipitate formed. It must be remembered, however, that this precipitate is not zinc ferrocyanide, for this, in contact with excess of potassium ferrocyanide, rapidly forms a double compound, $2K_2Zn_3(FeCy_6)_2$.

L. de K.

The Use of the Rotating Anode in Electrolytic Separations. Mary E. Holmes (*J. Amer. Chem. Soc.*, 1908, 30, 1865—1874).—The advantage of rotation over stationary electrodes even with low currents is demonstrated. On examining the tables given, the following points are noticed. Separation of cadmium from aluminium and magnesium is always possible. The best conditions for the separation of cadmium from chromium are the use of a high current with phosphoric acid as electrolyte; the separation also succeeds with a low current in presence of sulphuric acid. Separation of cadmium from iron is possible with a high current, but not with a low one. Separations of cadmium from cobalt and zinc are possible with a low, but not with a high, current. Separation of cadmium from nickel succeeds best with a high current. Separation of cadmium rom manganese succeeds best with a high current, but satisfactory esults are also obtained with a low current, using formic acid as lectrolyte. L. DE K.

Assay of Lead Sulphides. FELIX JACOBSOHN (*Chem. Zentr.*, 908, ii, 1291 ; from *Gummi Zeit.*, 1908, 22, 1200).—Commercial lead ılphide often contains sulphate, and therefore it is necessary to stimate the true sulphide, which is readily done by heating with ıming hydrochloric acid and collecting the hydrogen sulphide evolved ı an ammoniacal solution of silver nitrate. Any free sulphur may e extracted by boiling with a suitable solvent. L. DE K.

Detection of Mercury in Organs by means of the Microscope. . LOMBARDO (*Chem. Zentr.*, 1908, ii, 1788 ; from *Arch. Farm. sperim.*, 908, 7, 400).—The following methods, in which the mercury is reduced) the metallic state by means of stannous chloride, are stated) be capable of detecting the presence of one part of mercury in ,000,000.

Five c.c. of the filtered liquid (urine, stomach contents, etc.) are ixed with 5 c.c. of stannous chloride solution (prepared by dissolving 2 grams of stannous chloride in a mixture of 25 c.c. of hydrochloric cid and 75 c.c. of water) and submitted to centrifugal action for a few inutes. The precipitate is then examined under the microscope. he presence of a small quantity of albumin aids the reaction, and ractically every mercury salt, with the exception of the sulphide, ay be detected by the test.

The second method described consists in placing parts of the organs ı either 70% alcohol or 10% formaldehyde solution for about two ıys, then washing them with water, and immersing them in the annous chloride solution ; the pieces are next washed successively in ater, alcohol, and xylene, and embedded in paraffin. Sections are ıt, and, after the removal of the paraffin, are examined microscopi- ılly ; the mercury is seen as small globules. The tests will not etect the presence of mercury in decomposed organs, probably owing) the mercury having been converted into the sulphide. W. P. S.

Volumetric Estimation of Mercuric Salts. H. MORAWITZ *Zeitsch. anorg. Chem.*, 1908, 60, 456—458).—The author titrates ercuric chloride by means of "pure" *N*/10 potassium cyanide, which ıs been freed from any carbonate by addition of barium chloride. s indicator and catalyst, a saturated solution of *p*-nitrophenol *N*/50 hydrochloric acid is employed, of which 10 drops are lded. When checking this solution, 100 drops are used and the sult divided by 10. The number of c.c. of cyanide used are then educted from those used in the mercury titration. In these rcumstances, mercuric chloride behaves like a dibasic acid.

Probably other mercuric salts may be converted into chloride by eans of an alkali chloride. L. DE K.

Estimation of Ceria and other Rare Earths in Rocks. MAX ITTRICH (*Ber.*, 1908, 41, 4373—4375. Compare Meyer, D.R.-P.)2523, and Hauser, Abstr., 1908, ii, 987).—The presence of iron salts affects the precipitation of cerium as cerous oxalate. The best precipitating agent is ammonium oxalate, and when iron salts are present it is necessary to use a very large excess of the precipitating reagent. For example, with 0·2 gram of cerous sulphate and 15 c.c. of a concentrated solution of ferric salt, 200 c.c. of saturated ammonium oxalate are necessary. The precipitate is perfectly white and free from iron compounds, and should be washed with dilute ammonium oxalate solution. J. J. S.

Colloidal Reaction for some Metallic Salts. Edmund Stiasny (*Chem. Zentr.*, 1908, ii, 1296; from *Collegium*, 1908, 348).—A solution of an aluminium salt, even if containing but 0·01 mg. per c.c., gives a flocculent precipitate when 5 c.c. are boiled with 5 c.c. of tannin solution (1 : 1000) and 10 c.c. of *N*-sodium sulphate. Sodium acetate may also be used, and acts in the cold.

Similar precipitates are obtained with the salts of calcium, barium, strontium, magnesium, zinc, lead, chromium, and iron, but not so distinctly as in the case of aluminium; manganese, however, gives a good reaction when sodium acetate is used. L. de K.

Estimation of Manganese in Pig Iron by the Persulphate Method. H. Kunze (*Stahl u. Eisen*, 1908, 28, 1715—1716).—Two grams of pig iron or one gram of spiegel are dissolved in a 500 c.c. graduated flask with 30 c.c. of nitric acid, D 1·2. The flask is filled up, the graphite allowed to settle, and 25 c.c. of the liquid taken. To this are added 10 c.c. of the same nitric acid, and 5 c.c. *N*/10 silver nitrate (for pig iron), or 15—20 c.c. for spiegel. The solution is oxidised with persulphate to convert the manganese into permanganate, and titrated in the usual way (compare Rubricius, Abstr., 1905, ii, 766). C. H. D.

Influence of Copper on the Titration of Iron by the Zimmermann-Reinhardt Method. K. Schröder (*Zeitsch. öffentl. Chem.*, 1908, 14, 477—492).—A series of experiments to study the influence of copper on the accuracy of the estimation of iron by Zimmermann-Reinhardt's volumetric process (reduction with stannous chloride, addition of mercuric chloride, and titration with permanganate).

The presence of copper either slightly increases or decreases the amount of iron found; sometimes there is a compromise. The final conclusion arrived at is as follows: quantities of copper not exceeding 0·01% may be neglected in ordinary analyses of iron ores if the operations are conducted with due speed. But with more copper present, and in reference analyses, the copper should be first removed. Iron wire should not be used as a means of standardising permanganate if it is not free from copper, and the stannous chloride should be tested for that metal. L. de K.

Molybdates of Nickel and Cobalt. Hermann Grossmann (*Bull. Soc. chim.*, 1909, [iv], 5, 5).—A reply to Pozzi-Escot (Abstr., 1908, ii, 1042), pointing out that the latter has confused W. Marckwald with E. Marckwald, and that it was to the second of these investigators the author attributed correctly the process for the detection of nickel in presence of cobalt, referred to in his previous paper (Abstr., 1908, ii, 230). T. A. H.

Volumetric Estimation of Chromium with Potassium Ferricyanide. Hermann Bollenbach and E. Luchmann (*Zeitsch. norg. Chem.*, 1908, **60**, 446—455).—The chromic solution, which nust be free from metals precipitable by hydrogen sulphide, also from obalt, nickel, manganese and ferrous salts and other reducing norganic or organic substances, is poured into a freshly prepared olution of 4 to 12 grams of pure potassium ferricyanide to which 50 c.c. f 2*N*-sodium hydroxide have been added. After thorough stirring, queous barium hydroxide is added until all the chromate formed has recipitated, and the precipitate is collected on a double filter and well ashed. The filtrate is acidified with dilute hydrochloric acid, and itrated with permanganate solution which has been standardised, say, ith pure potassium ferrocyanide. If the permanganate contains xactly 3·546 grams per litre, 1 c.c. will represent 0·001947 gram of hromium. Chromates must be reduced by means of sulphurous acid, he excess of which is then removed by boiling. L. de K.

Reaction of Uranium and Cadmium Salts. P. Lemaire *Ann. Chim. anal.* 1909, **14**, 6—7).—The reagent consists of a 5% olution of thiosinamine, to 100 c.c. of which are added when required c.c. of sodium hydroxide. To 3—4 c.c. of the alkaline reagent are dded 2—3 drops of the solution to be tested, and the mixture is eated to boiling. Cadmium and uranium are the only metals which ield a yellow precipitate. L. de K.

Estimation of Antimony and Tin. Edward Cahen and ilbert T. Morgan (*Analyst*, 1909, **34**, 3—9).—The results are iven of a detailed examination of several methods which have been roposed for the estimation of these two metals. Vortmann and etzl's process (Abstr., 1905, ii, 655) was found to be trustworthy r the separation of antimony from tin, and for the estimation of the rmer metal if certain precautions, such as the absence of nitric acid r other oxidising agent, etc., are observed. The method does not, owever, admit of the estimation of tin by any simple process. It is ecommended that the antimony trisulphide obtained should be heated a temperature of 150—180° in an atmosphere of carbon dioxide efore being weighed. The method described by Czerwek (Abstr., 906, ii, 708) gave good results in the case of tin, but was quite ntrustworthy for the estimation of antimony. The best method was und to be that of Henz (Abstr., 1904, ii, 150). W. P. S.

Estimation of Tin in Tin-Plate. Karl Meyer (*Zeitsch. angew. hem.*, 1909, **22**, 68—69).—Twenty to fifty grams of the cleansed aterial are cut up into small pieces and placed in a spacious basin. fficient water is added to cover the metal, and this is then heated 80°, when 1 to 2·5 grams of sodium peroxide are added. When the fervescence ceases a little, another gram of the peroxide is added, and, when the evolution of gas ceases altogether, the flame is removed and the undissolved iron is examined for any tin. Should there still be some left, more peroxide is added, and the whole heated to boiling. Finally, the iron is washed with boiling water, then with alcohol, dried, and weighed.

Any lead present is also dissolved in the alkaline liquid. If desired, the true amount of tin may be estimated in the solution. L. de K.

Organic Analysis with Sodium Peroxide. M. Emanuel Pozzi-Escot (*Ann. Chim. anal.*, 1909, **14**, 5—6).—A slight modification of Von Koneck's process. The nickel crucible is fitted with a lid which can be tightly closed by means of a bayonet joint, and is fitted with a tube 3 mm. in diameter and 7—8 cm. in height. 0·2 Gram of the substance is carefully mixed with 4—5 grams of sodium peroxide and introduced into the crucible. After fixing on the lid, a slight heat is applied with a small flame, when very soon the action sets in, causing the crucible to become white hot. After cooling for ten minutes, the lid is removed, and the crucible is placed in a vessel filled with water. The process gives satisfactory results for the estimation of the halogens; nitrogen is converted into nitrate, sulphur into sulphate, and phosphorus and arsenic are also retained as phosphate and arsenate. The author, however, cannot recommend the process for the estimation of the carbon. L. de K.

A New Colour Reaction of Petroleum. Charles Arragon (*Chem. Zeit.*, 1908, **33**, 20—21).—Equal volumes of petroleum and nitric acid, D 1·4, free from nitrous acid, are well shaken for half a minute. Pure American petroleum turns a fine violet, whilst the acid layer turns yellow. Austrian, Gallician, and Russian petroleum turns intensely yellow, the acid becoming brown. In the case of mixtures, the whole first turns a pale violet, and then suddenly changes to yellow. In this manner, 10% of Austrian oil may be detected in American petroleum. L. de K.

Some Reactions and Properties of Essential Oils. Louis Duparc and Alf. Monnier (*Arch. sci. phys. nat.*, 1908, 26, 609—639).—This research was undertaken in order to discover a simple method of detecting absinthe and similar liqueurs containing thujone. A modified form of Legal's reagent is suggested for this purpose.

Preliminary experiments on the determination (*a*) of the quantities of water necessary to just produce turbidity in alcoholic solutions of various essential oils, (*b*) of the quantities required to just ensure "complete precipitation" of oils from such solutions, and (*c*) observations on the opacities of such "completely precipitated" preparations, showed that these methods could not be employed satisfactorily for distinguishing between liqueurs containing thujone and those free from this constituent, but containing other oils. Similarly, the iodometric method devised by Sanglé-Ferrière and Cuniasse (Abstr., 1903, ii, 247, 336, 337) for the estimation of essential oils in absinthe was found to give different results even with the same distillate under the same conditions, and is therefore untrustworthy.

Cuniasse's observation (Abstr., 1907, ii, 413) that Legal's reagent gives a deep red coloration with oils containing thujone, such as those of wormwood and tansy, was confirmed. Of the other essential oils and their constituents tried, citral is the only one likely to occur in liqueurs which gives a red colour likely to be mistaken for that given by thujone, although somewhat similar colours are also given by oils of vervain, caraway, and rue. Red colorations are also given by rum, brandy, and other spirits, due to the aldehydes they contain. The application of the test has therefore been modified. To 100 c.c. of the liqueur, 1 c.c. of aniline and 1 c.c. of syrupy phosphoric acid are added, and the mixture heated during one hour in a reflux apparatus. The mixture is then distilled, and 90 c c. collected. To 10 c c. of this distillate, 2 c.c. of zinc sulphate solution (10%), 0·5 c.c. of sodium nitroprusside solution (10%), and, after cooling, 4 c.c. of sodium hydroxide solution (5%) are added. The cooled liquid is acidified with 2—3 c.c. of acetic acid, when, if thujone is present, a gooseberry-red precipitate is formed. Citral gives an orange-red precipitate under similar conditions, but this constituent, if originally present, would be eliminated by the preliminary treatment of the liqueur. The precipitate formed is much more stable than the red colour given by Legal's reagent. If very small quantities of thujone are present, a preliminary concentration of the oils in the liqueur is effected by precipitating them with water and extracting with light petroleum, which is then removed by careful distillation, the residue being dissolved in 60° alcohol. T. A. H.

Relation between the Cryoscopic Points of Wines and their Alcoholic Strength. W. Mestrezat (*Ann. Chim. anal.*, 1909, 14, 11—14).—The author has found that the alcholic degree of wines may be determined with sufficient accuracy by dividing the cryoscopic points by 0·44.

The apparatus resembles a Winkler cryoscope (for milk testing). It is composed of a Violette-tube, in which moves, by way of a stirrer, a platinum wire having a spiral at its lower end; a thermometer, divided to 1/50°, occupies the axis of the tube. Twenty-five c.c. of the wine are placed in the apparatus, which is then cooled in a mixture of ice and salt to $-6°$ or $-7°$. The thermometer gradually lowers, but then suddenly rises up to a fixed point, which is the cryoscopic point. L. de K.

Estimation of the Total Acidity of Wines. Ottorino Carletti (*Boll. chim. farm.*, 1908, 47, 787—788).—When the acidity of a red wine is estimated by titration with sodium hydroxide solution in presence of phenolphthalein, the change of colour of the liquid can be easily seen if only the light traversing the solution, and not the reflected light as well, be observed. For this purpose the author uses a box blackened inside and having a circular hole in the top just large enough to admit the beaker used in the titration, and another slightly smaller hole in the bottom; the height of the box should be rather less than that of the beaker. A white porcelain plate, rotatable about a horizontal axis, is so arranged that the maximum of light is reflected into the beaker. For the titration with $N/10$ sodium hydroxide solution, 10 c.c. of wine diluted with a few c.c. of water are taken, together with five drops of a 1% alcoholic solution of phenolphthalein. T. H. P.

Some of the Fatty Acids occurring in Butter Fat. R. K. Dons (*Zeitsch. Nahr. Genussm.*, 1908, **16**, 705—725).—In a previous paper (Abstr., 1908, ii, 238), the author has given a method for the estimation of caprylic [octoic] acid in butter fat, and, as this method depends on the different solubility of the lower fatty acids in hot water, he now gives the results of an investigation on the solubility and volatility of these acids. Capric acid [decoic acid], although by itself slightly soluble in cold water, is not extracted by hot water from mixtures containing higher fatty acids; octoic acid dissolves to a slight extent, and, when a mixture of fatty acids is shaken with several successive quantities of hot water, small amounts of this acid are found in each of the extracts. Hexoic acid is completely extracted from mixtures with higher fatty acids on repeated treatment with hot water, and butyric acid is obtained in solution by shaking the fatty acid mixture once with water. The total quantity of octoic acid in a mixture of butter fatty acids may be estimated by the method described previously if about 1250 c.c. of distillate are collected and allowance made for the small quantity of the acid extracted from the fatty acids by the hot water. A method for the estimation of decoic, lauric, and myristic acids is also suggested; it is based on the different rates at which these acids distil in a current of steam. W. P. S.

Colour Reaction of Oleic Acid. Quick Method of Identifying Vegetable Fibre. A. Manea (*Chem. Zentr.*, 1908, ii, 1702; from *Bul. Soc. Stiente Bucuresti*, 1908, **17**, 256—257).—Cellulose, as, indeed, all vegetable fibres, when mixed with strong sulphuric acid and oleic acid or its esters, gives a red coloration when water is added to the solution so as to cause it to become warm. Stearic, palmitic, margaric, butyric, and *iso*butyric acids do not behave in this manner, neither do animal fibres when in presence of concentrated sulphuric acid and oleic acid give this coloration. It is thus possible to use this reaction for discriminating between animal and vegetable fibres, and also for identifying oleic acid. Various fractions of crude petroleum, more especially that boiling at 250°, give a similar colour reaction when care is taken that the addition of water to the strong sulphuric acid does not greatly increase the temperature. J. V. E.

Nature of the Chromophore Group in the Resorcinol Test for Tartaric Acid. Georges Denigès (*Bull. Soc. chim.*, 1909, [iv], 5, 19—24).—Results of the application of the resorcinol test (Abstr., 1896, ii, 80) to a large number of substances show that the characteristic red to reddish-violet colour is only given by those containing the complex $\mathrm{HO{\cdot}\overset{|}{\underset{|}{C}}\ \overset{|}{C}{\cdot}OH}$. This group may be present as such, as in ethylene glycol, or it may be partly, or wholly, esterified, as in β-chlorolactic acid or dibenzoyltartaric acid. In order that the group should behave as a chromophore, the spare affinities of the carbon atoms, as shown above, must be united to (1) hydrogen atoms (ethylene glycol and its derivatives), or (2) carbon, itself united to hydrogen (homologues of ethylene glycol), or (3) a carbinol grouping. The colour produced is most intense when the chromophore is in the near neighbourhood of a carboxyl group, as in tartaric, tartronic, and trihydroxyglutaric acids. These rules are also applicable when resorcinol is replaced by other polyhydric phenols, such as phloroglucinol.

Applied in the following manner, the test may be used to distinguish glyceric, tartaric, and tartronic acids. Two c.c. of a mixture of 10 c.c. each of sulphuric acid (D 1·84) and acetic acid, with 1 c.c. of a 2% solution of resorcinol, are heated to boiling and 0·1 c.c. of a solution of the acid (0·005% in water) added. With glyceric acid, the liquid acquires immediately a pink tint, passing rapidly into gooseberry-red. Tartaric acid gives a pomegranate-red, appearing more slowly, and with a solution one-tenth the above strength the colour is wine-red. With tartronic acid a dead-leaf colour appears slowly. On boiling each of these liquids, the red colours of the first two become intensified, whilst the colour of the third changes to wine-red.

Substances such as ethylidenelactic acid contain the chromophore, but do not give the colour reaction, owing to their decomposition by the sulphuric acid used. T. A. H.

Separation of Benzoic and Cinnamic Acids. K. SCHERINGA (*Pharm. Weekblad.*, 1908, **45**, 1535—1536).—A reply to de Jong (Abstr., 1908, ii, 993). The author admits that benzoic acid is formed if the excess of permanganate added is not removed quickly.

A solution of benzoic acid in ether may be evaporated and the residue dried at 40° on a water-bath without any appreciable loss of acid. L. DE K.

Microscopic Analyses of Soluble, Crystallisable Substances. [Salicylic Acid. Caffeine.] ANNIBALE FERRARO (*Boll. chim. farm.*, 1908, **47**, 789—790).—In order to decide whether a sample of salicylic acid is pure, the author evaporates a drop of its ethereal solution on a microscope slide, and examines the crystalline residue under the microscope, similar examination being made of ethereal solutions of salicylic acid mixed with similar powders, such as benzoic acid. By such means, the approximate proportions of the components in a mixture can be estimated.

The purple-red colour obtained by treating caffeine with nitric acid or chlorine, and subsequently with ammonia, is sometimes not clearly shown by caffeine extracted from coffee by means of chloroform or ether, but the caffeine can be rendered evident by evaporating a drop or two of the chloroform or ethereal extract and examining the residue under the microscope; it is, however, found that the appearance of the prismatic crystals of caffeine varies with the solvent used and with the concentration of the solution from which they are deposited.

T. H. P.

Objections to the Use of Potassium Dichromate as a Preservative of Milk Destined for Analysis. A. Monvoisin (*Compt. rend.*, 1908, **147**, 1403—1404).—In addition to the disadvantages already mentioned by Grélot (Abstr., 1907, ii, 513), there is the further objection that milk containing potassium dichromate always produces a blue coloration with *p*-phenylenediamine; hence it is impossible to decide whether the milk has been boiled or whether hydrogen peroxide has been added. G. B.

Detection and Estimation of Formaldehyde in Milk. Herbert S. Shrewsbury and Arthur W. Knapp (*Analyst*, 1909, **34**, 12—13).—To 5 c.c. of milk contained in a test-tube are added 10 c.c. of concentrated hydrochloric acid containing 0·1% of nitric acid; the mixture is shaken vigorously, and kept for ten minutes in a water-bath at a temperature of 50°. The tube and its contents are then cooled rapidly to about 15°. A violet coloration denotes the presence of formaldehyde, and its intensity indicates the amount, which may be estimated by comparison with standard mixtures of milk and formaldehyde treated in the same manner. The acid reagent should be freshly prepared. W. P. S.

Estimation of Aldehydes in Oil of Lemon. Alexander H. Bennett (*Analyst*, 1909, **34**, 14—17).—The method proposed is a modification of that described originally by Walther (Abstr., 1900, ii, 173); the use of sodium hydrogen carbonate is discontinued, owing to the objection that the carbon dioxide evolved carries off hydroxylamine. The details of the modified process are as follows. Twenty c.c. of the oil of lemon are mixed with 20 c.c. of *N*/2-alcoholic hydroxylamine hydrochloride solution, and to the mixture are added about 8 c.c. of *N*/1-alcoholic potassium hydroxide solution and 20 c.c. of alcohol. The mixture is boiled gently under a reflux apparatus for thirty minutes, and then cooled. The condenser is washed, and the contents of the flask are diluted by the addition of about 250 c.c. of water, the solution being then rendered neutral to phenolphthalein and titrated with *N*/2-sulphuric acid, using methyl-orange as indicator. The number of c.c. of acid required is subtracted from the number used in a blank experiment in which no oil of lemon is present, and the difference multiplied by 0·076 to obtain the weight of citral.
W. P. S.

Estimation of Small Quantities of Impurities in *o*-Toluidine and *o*-Nitrotoluene. Arnold F. Holleman (*Rec. trav. chim.*, 1908, **27**, 458—462).—In addition to an account of work published previously (Abstr., 1905, i, 272), this paper contains details of the analysis of two samples of commercially "pure" *o*-toluidine, which were found to contain 0·9% and 4·1% respectively of impurities. The method already described (*loc. cit.*) can be applied to the analysis of *o*-nitrotoluene after reduction with iron and hydrochloric acid.
W. O. W.

Estimation of Alkaloids. Bitter Principles and Glucosides with the Zeiss Immersion Refractometer. Franz Utz (*Chem. Zeit.*, 1909, 33, 47—49).—A preliminary paper. Successful attempts have been made to determine the quantity of some alkaloids from their refraction in the Zeiss instrument. The following have as yet been tried. *Caffeine* in aqueous solution, *morphine* in methyl alcohol, also the hydrochloride in acid and aqueous solutions, *quinine*, also the hydrochloride, in methyl alcohol, and *brucine* in methyl alcohol solution. L. de K.

An Error in the Estimation of Caffeine by Juckenack and Hilger's Method. K. Lendrich and Rudolf Murdfield (*Zeitsch. Nahr. Genussm.*, 1908, 16, 647—658).—Experimental evidence is given that caffeine cannot be extracted completely from a perfectly dry residue, such as is obtained in the method described by Juckenack and Hilger (Abstr., 1897, ii, 611), by means of carbon tetrachloride. The extraction of the alkaloid is, however, complete if the residue is moist. It is therefore recommended that the aqueous extract of the coffee should be treated, as described by Juckenack and Hilger, with aluminium hydroxide and sodium hydrogen carbonate and filtered. The portion of the filtrate taken for the estimation is evaporated, mixed with powdered aluminium hydroxide and sand, and, while still in a moist condition, extracted in a Soxhlet apparatus for about ten hours with carbon tetrachloride. W. P. S.

The Caffeine-content of Raw Coffee and a Modification of Juckenack and Hilger's Method for Estimating Caffeine. Rudolf Hefelmann (*Zeitsch. offentl. Chem.*, 1908, 14, 448—450).—From 0·864 to 1·669% of caffeine was found in specimens of commercial unroasted coffee beans; these results lie very close to the figures (1·00 to 1·75%) given by the German Food Regulations as the limits for the caffeine-content of unroasted coffee. It is also pointed out that coffee free from caffeine is now on the market. Juckenack and Hilger's method for the estimation of caffeine (Abstr., 1897, ii, 611) tends to give too low results unless the residue, after extraction with carbon tetrachloride, is moistened, mixed with magnesium oxide, re-dried, and subjected to a further extraction with this solvent.

W. P. S.

The Theobromine-content of Cocoa and a New Method for the Estimation of Theobromine. Adolf Kreutz (*Zeitsch. Nahr. Genussm.*, 1908, 16, 579—584).—A portion of the theobromine occurring in cocoa is extracted together with the fat in the process described by the author (Abstr., 1908, ii, 641) for the estimation of the latter; cocoa also contains a quantity of theobromine in the form of a glucoside, and this portion can be separated only after treating the cocoa with an acid. The method now proposed for the estimation of the total theobromine is as follows. From 1·5 to 2 grams of the cocoa are treated with chloral alcoholate as described (*loc. cit.*), and the residue of fat obtained is, after being weighed, dissolved in cold carbon tetrachloride; the theobromine present in the fat remains insoluble, and is separated by filtration. The solution of the fat in carbon tetrachloride is evaporated, and the residue of fat weighed. The difference between the two weighings gives the amount of theobromine. The residue of cocoa obtained in this part of the process is then dried and boiled with 50 c.c. of 4% sulphuric acid for forty-five minutes in a reflux apparatus. The hot solution is next neutralised by the addition of moist barium carbonate, and evaporated to dryness; the residue is mixed with sand, extracted with chloroform for five hours in a Soxhlet apparatus, and the residue of theobromine obtained on evaporating the solvent is weighed. From the results of estimations given, it is seen that the two kinds of theobromine cannot be separated from each other quantitatively; the total amount of theobromine found in various cocoas varied from 1·99 to 3·85%.

W. P. S.

Detection of Morphine. C. Reichard (*Pharm. Zentr-h.*, 1908, 49, 951—954).—Morphine may be identified by means of the reactions given previously by the author (Abstr., 1905, ii, 68; 1906, ii, 637), and also by the blue coloration which is obtained when a neutral morphine solution is mixed with ferric chloride or ferric acetate solution. Titanic acid dissolved in concentrated sulphuric acid gives with morphine a reaction similar to that obtained with iodic acid. In every case, better reactions are obtained if the morphine is tested in the solid state and not in solution. It is also pointed out that morphine is partly converted into dehydromorphine in the animal body, and that this should be remembered when testing for morphine in cases of suspected poisoning. Dehydromorphine may be detected, or distinguished, from morphine by the shape of its crystals, its very slight solubility in dilute acids, and by giving a blood-red coloration with the formaldehyde reagent mentioned previously. W. P. S.

Estimation of Proteins in Milk treated with Formaldehyde. Direct Estimation of Formaldehyde in Milk. Angelo Agrestini (*Chem. Zentr.*, 1908, ii, 1640—1641; from *Staz. sperim. agrar. ital.*, 41, 520—529).—A criticism of Denigès' mercury process for the estimation of proteins in milk. In the case of samples containing formaldehyde, the addition of a little 10% hydroxylamine hydrochloride solution is recommended before adding the mercury reagent. The presence of formaldehyde may thus be proved by titrating before and after addition of hydroxylamine hydrochloride. L. de K.

Estimation of Albumin in Urine. Adolf Jolles (*Ber. Deut. pharm. Ges.*, 1908, 18, 598—599).—One hundred c.c. of the urine are placed in a beaker and, if necessary, neutralised with acetic acid, 5 c.c. of formalin reagent are added, and the liquid is heated on the boiling water-bath for thirty minutes. The albumin is then at once collected on a weighed filter, dried at 110°, washed first with boiling water, then with alcohol and ether, again dried at 110°, and weighed. Any co-precipitated mineral matter is allowed for, as usual.

The reagent is prepared by mixing 50 c.c. of 1% acetic acid, 50 c.c. of commercial formaldehyde, and 15 grams of sodium chloride.

L. de K.

A New Albuminometer. L. E. Walbum (*Chem. Zentr.*, 1908, ii, 1632; from *Deutsch. med. Woch.*, 1908, **34**, 1728—1729).—The principle of the method consists in the fact that trichloroacetic acid gives a turbidity with weak solutions of albumin. The degree of turbidity is then determined in the author's apparatus, which is based on comparison with a standard milky glass. The results are, however, only approximate. L. de K.

Separation of Caseinogen from Human Milk. Rodolphe Engel (*Biochem. Zeitsch.*, 1908, **14**, 234—237).—The milk is diluted five-fold and acidified with acetic acid; the mixture is cooled for two to three hours with occasional shaking, then warmed to 40° for a few minutes, and finally filtered. W. D. H.

Phenolphthalein as a Reagent for Blood. M. Emmanuel Pozzi-Escot (*Bull. Soc. chim. Belg.*, 1908, **22**, 415—416).—It has been stated by Delarde and Benoit (*Compt. rend. Soc. Biol.*, 1908, **64**, 990) that an alkaline solution of phenolphthalein forms a more delicate test for blood than tincture of guaiacum. The author finds that the reagent obtained by dissolving one gram of phenolphthalein in 50 c.c. of sodium hydroxide solution, and decolorising by reduction with excess of zinc dust, is re-coloured in the presence of hydrogen peroxide, not only by fresh blood, but also by extract of malt, saliva, the ash of blood, pus, most organic secretions and vegetable extracts, certain urines free from blood, and by a very large number of metallic salts, such as those of cobalt, manganese, iron, and lead. The conclusion is drawn that, as a test for blood, the reagent is absolutely valueless.

E. H.

Clinical Methods for the Detection of the Colouring Matters of Blood and Some Related Colouring Matters. Otto Schumm (*Arch. Pharm.*, 1909, **247**, 12—27).—A critical résumé of the methods available for the detection of blood in urine, fæces, stomach contents, etc., in the course of which the delicacy and best conditions for the application of the absorption spectrum test, the guaiacum (compare Abstr., 1907, ii, 320), aloin, benzidine (Abstr., 1907, ii, 827), and potassium cyanide tests are discussed, as also the hæmochromogen and hæmatoporphyrin tests. Lastly, the detection of urobilin in urine and fæces by a modification of the zinc chloride test is dealt with.

T. A. H.

Reaction of Bile Acids with Rhamnose and δ-Methylfuraldehyde. Carl Neuberg (*Biochem. Zeitsch.*, 1908, **14**, 349—350).—The reaction mentioned by Jolles (Abstr., 1908, ii, 998) has been described previously by Neuberg and Rauchwerger (Abstr., 1905, ii, 122). The same reaction is given, not merely by bile acids, but also by cholesterol and camphor and terpene derivatives. J. J. S.

Detection of Urobilin in Urine. Eduard Strauss (*Münch. med. Woch.*, 1908, No. 49, reprint).—The urine is acidified with a few c.c. of acetic acid, and precipitated with about a fourth the volume of lead acetate; the filtrate is extracted with amyl alcohol, which, after this treatment, readily dissolves out the urobilin. The extract gives the characteristic fluorescence with ammonium zinc chloride. S. B. S.

Simplification of the Jakoby-Solm's Ricin Method for the Estimation of Pepsin. Max Einhorn (*Chem. Zentr.*, 1908, ii, 1295; from *Berlin klin. Woch.*, 1908, 45, 1567—1568).—The modified apparatus consists of a vacuum glass vessel with a stand for twelve calibrated pepsin tubes; it is filled with water at 50—60°, and well corked. Each tube is marked 2, 3, 3·5 c.c., and at its lower end it is graduated in millimetres. Each tube is filled with the 1% ricin solution up to 2 c.c., the diluted pepsin solutions (gastric juice) are then added up to 3 c.c., and finally *N*/10 hydrochloric acid up to 3·5 c.c. The corked tubes are shaken and placed in the vacuum vessel. After thirty minutes, those tubes are noted in which the precipitate has quite disappeared, and at the same time the height of the precipitate in the others is noted. Normal gastric juice when diluted 10 to 20 times gives a precipitate disappearing in thirty minutes; if there is still a precipitate with a ten-fold dilution, the pepsin content is insufficient, and if it disappears with a forty-fold dilution the amount of pepsin is excessive. L. de K.

Soil Analysis. C. Bloch and M. Hoffmann (*Bied. Zentr.*, 1908, 37, 721—722; from *Mitt. landw. Inst. Univ. Breslau*, 1907, 4, Heft 1—2).—In Thiele's method of soil sampling (*ibid.*, 3, Heft 2), ten samples are taken with a spade ten times at equal distances for an area of $\frac{1}{4}$ hectare. The number of samples is then reduced to ten, or 40 per hectare, by mixing. The samples were found to yield unsatisfactory results, the percentages of nitrogen varying from 0·1450 to 0·1556.

To obtain samples for mineral analysis, a spadeful of soil was taken five times at equal distances (on a surface of 2·5 square metres) after removing about 5 cm. of surface soil. This was repeated five times, and in this manner, five average samples obtained. The samples were obtained from four plots which had received each year (1) potassium, (2) nitrate, (3) no manure, and (4) complete manure; the total nitrogen and mineral constituents were determined in each. The potassium results in (4) varied from 0·0169 to 0·0672, and the other results were more or less divergent.

The results show that, whilst it would be incorrect to select concordant results and ignore the others, approximately correct results can generally be obtained by this method by calculating the total means and the probable errors. Even then, however, it was not always found possible to obtain indications of continuous manuring. N. H. J. M.

General and Physical Chemistry.

Change in Refractive Index with Temperature. I. K. George Falk (*J. Amer. Chem. Soc.*, 1909, 31, 86—107).—Measurements of the refractive index of certain liquids for the C, D, F, and G lines were made with a Pulfrich refractometer at short intervals of temperature from about 20° to 70°. For the six typical liquids examined, the refractive index alters in a linear manner with the temperature. The results for the D line are given by the following equations, t representing the temperature: Di*iso*amyl, $n_D/1{\cdot}41750 + t/3173{\cdot}24 = 1$; dimethylaniline, $n_D/1{\cdot}56845 + t/3143{\cdot}19 = 1$; *n*-heptyl alcohol,

$$n_D/1{\cdot}43141 + t/3867{\cdot}43 = 1\ ;$$

benzyl alcohol, $n_D/1{\cdot}54875 + t/3644{\cdot}12 = 1$; *n*-butyric acid,

$$n_D/1{\cdot}40580 + t/3558{\cdot}99 = 1\ ;$$

acetylacetone, $n_D/1{\cdot}45987 + t/2703{\cdot}32 = 1$. The respective densities at different temperatures, and the dispersions at 10° and 80°, are also given, and the results are compared with those obtained by previous observers.

The values of the three usual expressions for the refraction: $(n^2 - 1)/d$, $(n - 1)/d$, and $(n^2 - 1)/(n_2 + 2)d$, have been calculated at intervals of temperature between 10° and 80°. In all cases the refraction increases or decreases continuously with rising temperature. The observed values of the molecular refractivity for the six compounds in question are in fair agreement with those calculated from the atomic refractions according to Brühl.

The refractive index of freshly distilled ethyl acetate is slightly different from that obtained after it has been kept for some time: a result ascribed to isomeric change. G. S.

Absorption Spectra of Neodymium and Praseodymium Chlorides in Water, Methyl Alcohol, Ethyl Alcohol, and Mixtures of these Solvents. Harry C. Jones and John A. Anderson (*Proc. Amer. Phil. Soc.*, 1908, 47, 276—297).—The absorption spectra were obtained by passing the light from a spark between carbon terminals saturated with uranium and molybdenum salts through the solution, and photographing the spectra produced by a grating. The red end of the spectrum was obtained from a Nernst filament.

The absorption spectrum of an alcoholic solution of neodymium or praseodymium chloride differs considerably from that of the aqueous solution. The bands of the alcoholic solution lie nearer to the red than those of the aqueous solution, and in the case of praseodymium chloride an additional strong band appears. The solutions in methyl and in ethyl alcohol are closely similar. In mixtures of alcohol and water, the two spectra are superposed. All the solutions show considerable deviations from Beer's law. The theory of Ostwald, that he absorption is due mainly to the ions, is insufficient to account for he facts, and it is considered that the formation of solvates (combinations of the solvent with parts of the dissolved substance) must be assumed. Both the molecules and the ions formed from them are considered to be in combination with the solvent. C. H. D.

Test of Beer's Law of Absorption.

F. STUMPF (*Physikal. Zeitsch.*, 1909, 10, 29—32).—The light absorbed by a layer of solution of 1 mm. thickness has been compared with that absorbed by 1500 mm. of a second solution, the concentrations being in the ratio 1500 : 1. For solutions of aminoazobenzene in benzene, Beer's law is satisfied within the limits of the estimated experimental error. For this and other coloured substances in ethyl-alcoholic solution, deviations were found, but the author considers that the two differently concentrated solutions are not strictly comparable, because of dissociation changes. H. M. D.

Polymerism as the Cause of the Difference of Colour of Halides and Sulphites.

ARTHUR HANTZSCH (*Ber.*, 1909, 42, 68—85).—The colour of many haloid salts, inorganic and organic, increases in intensity with the atomic weight of the halogen. Explanations of the phenomenon have hitherto been evaded or attempted by the theory of the ionisation of chromophores (Decker, Abstr., 1904, ii, 702). This explanation is untenable, for, amongst other objections, the author points out that true ionisation is immeasurably rapid, whereas Decker has in some cases been able to follow his colour changes colorimetrically; moreover, the author has shown previously that, in the absence of constitutive change, undissociated salts and their ions are optically identical.

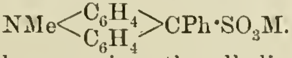
The colour change in question is to be referred to polymerisation, although at present definite evidence has been obtained only in the case of organic halides. For example, of the 5-phenyl-10-methylacridonium halides, the yellow solution of the chloride and the blackish-brown solution of the iodide are shown to be unimolecular and termolecular respectively by the ebullioscopic method. Since the anhydrous solids have similar colours, they may be assumed to be unimolecular and termolecular respectively. In dissociating solvents the termolecular iodide passes more or less into the unimolecular form; the greater the concentration of the solution, and (more important) the smaller the dissociating action of the solvent, the greater is the amount of the dark-coloured termolecular modification; for example, in alcohol the iodide is yellowish-brown, and in water, yellowish-green.

The chloride in aqueous or alcoholic solution is, optically, almost identical with the phenylmethylacridonium salts of oxy-acids, which conform to Beer's law.

Evidence for the equilibrium of the termolecular and the unimolecular modifications in the solid state is found in the bromide, which in the anhydrous condition is distinctly darker than the chloride, and therefore may be regarded as a solid solution of the brownish-black termolecular bromide in the yellow unimolecular modification; the hydrate of the bromide is yellowish green, so that by the addition of the water of crystallisation the termolecular form has been changed almost completely into the unimolecular.

Very interesting is the behaviour of 5-phenyl-10-methylacridonium sulphite. In contradistinction to the sulphate and the selenite, which possess the typical yellowish-green colour of the unimolecular salts, the sulphite can only be obtained in a dark green or a brown modification. The dark green sulphite, which separates from aqueous or alcoholic solution, is changed to the brown form in chloroform, whilst the converse change of the brown to the green is slowly accomplished by alcohol or ether. Unfortunately, the molecular complexity of these forms cannot be determined, but it is only rational to suppose that the brown sulphite, like the brown iodide, is termolecular; the dark green sulphite is regarded as bimolecular.

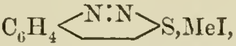
The double salts with alkali sulphites, $(C_{20}H_{16}N)_2SO_3,M_2SO_3$, which are colourless and stable only in alkaline solution, are probably ψ-sulphites, namely, phenylmethyldihydroacridinesulphonates,



$$NMe{<}{\substack{C_6H_4\\C_6H_4}}{>}CPh{\cdot}SO_3M.$$

They are decomposed by water into the alkali sulphite and the dark green acridonium sulphite, and behave generally like the leucosulphonates of the triphenylmethane dyes examined by Hantzsch and Osswald.

Results similar to the preceding have also been obtained with 5-phenylacridonium, acridonium, and methylacridonium salts; the majority of the salts are yellowish-green, but the iodides are brown and the sulphites olive-green and brown; their examination is rendered difficult by their instability and slight solubility. Quinolinium and *iso*quinolinium salts are usually colourless, but abnormal yellow iodides and sulphites have been obtained which dissolve in chloroform without change of colour. 1-Methylpyridinium halides are colourless; the fused iodide is deep yellow, but becomes colourless again at the ordinary temperature.

o-Diazophenylene sulphide methiodide,  $C_6H_4{<}\overset{N:N}{\rule{2em}{0pt}}{>}S,MeI$, is usually obtained in golden-yellow needles (Jacobson, Abstr., 1894, i, 123), but by the addition of ether to a chloroform solution, which has been kept for some hours, or heated for a few seconds, or inoculated with a trace of bromine or iodine, an amorphous, gelatinous, dark green modification is precipitated, which changes quantitatively into the yellow form at 80° or in contact with alcohol or chloroform. The green form is probably a polymeride.

Since all the preceding colour changes are time phenomena, they must be referred, not to a mere change in the degree of dissociation, but to chemical changes, that is, to polymerisation. Moreover, since the salts retain in the solid form the same colour as they have in solution, the colour of the solid salts must also be referred to different degrees of polymerisation, and not to different states of aggregation.

The experimental part of the paper deals with the preparation of the preceding salts, their colour in different solvents, the measurement of the extinction coefficients of their solutions, and wherever possible, the determination of their molecular weights by the ebullioscopic method. C. S.

Measurement of Rotatory Dispersive Power in the Visible and Ultra-violet Regions of the Spectrum. T. MARTIN LOWRY (*Proc. Roy. Soc.*, 1908, *A*, 81, 472—474).—An account is given of improvements which have been made in the method of determining rotatory dispersive power. As a result of these, the intense line spectra yielded by metallic arcs can be used for polarimetric measurements. For this purpose, a parallel beam from the arc is thrown on to the slit of a constant deviation spectroscope. An achromatic lens, which is substituted for the observing tube, is used to throw a magnified image of the slit on to the polarising prisms which give a triple field. By suitably adjusting the constant deviation prism, the whole field can be illuminated with monochromatic light of any desired wave-length.

For observations with ultra-violet light, an arc passed between a carbon and a magnetite electrode is used. A beam from this is thrown by a quartz condenser on to the field of the polarising Foucault prisms, and by means of a quartz-calcite lens, substituted for the analyser-telescope, a diminished image of the field is thrown on to the slit of an ultra-violet spectroscope. The spectrum is photographed, and the line, for which the intensity in the three parts of the field is the same, is identified on the negative.

The rotations produced by 100 mm. of methyl camphorcarboxylate at 20° are recorded for wave-lengths ranging from $\lambda = 6708$ to $\lambda = 4359$. H. M. D.

Certain Optical and Magneto-optical Properties of Crystals at Low Temperature. JEAN BECQUEREL (*Compt. rend.*, 1909, 148, 158—161. Compare Becquerel and Onnes, Abstr., 1908, ii, 338).—The author controverts a few of the conclusions arrived at by Du Bois and Elias (*Ann. Physik*, 1908, 27, 233).

In an absorption spectrum the width of the bands is proportional to the square of the absolute temperature, provided that width be defined as the difference in wave-lengths of the two vibrations with maximum difference in refractivity. This law holds good down to − 190°, but beyond that the bands often enlarge again.

The changes of frequency produced by a magnetic field are independent of temperature. R. J. C.

Electro-chemistry of Light. IV. WILDER D. BANCROFT (*J. Physical Chem.*, 1909, 13, 1—90. Compare Abstr., 1908, ii, 788).—A compilation of extracts from papers in which the phenomenon of solarisation has been investigated or discussed. H. M. D.

The Radioactive Elements. I. DANIEL STRÖMHOLM and THE SVEDBERG (*Zeitsch. anorg. Chem.*, 1909, 61, 338—346).—The radioactive elements are usually found in such small quantities as to render a study of their chemical reactions impossible. Light may be thrown on their chemical relations by observations of their isomorphism.

Ammonia is added to a solution of thorium nitrate, precipitating all elements of the thorium series except thorium-*X*. The solution is concentrated, and various salts are then dissolved in different portions of it, crystallising on cooling. In this way, thorium-*X* is found to be carried down by barium and lead nitrates and by barium chloride, but not by potassium, bismuth, or lanthanum-ammonium nitrates. This indicates that thorium-*X* is isomorphous with barium and lead. It is not precipitated by hydrogen sulphide, and the conclusion is drawn that thorium-*X* belongs to the group of alkaline earth metals. The same result was obtained on crystallising the salts from an old solution of thorium nitrate.

Of the other elements of the series, thorium-3 appears to be isomorphous with thorium, and thorium-2 possibly with lanthanum, although it may be complex. C. H. D.

A Few Chemical Changes Induced by Radium. New Method for the Detection of Amygdalin. H. Jermain M. Creighton (*Trans. Nova Scotia Inst. Sci.*, 1908, 12, 34—48).—In these experiments radium bromide of activity 1,000,000 was employed, enclosed in a glass tube so that only α- and β-rays were used.

Two squares of white tin, 25 × 25 × 1 mm., were placed in two compartments of a lead box, separated by a lead partition. The end of the radium tube was placed about 1 mm. above one square, and the apparatus kept at 0° for four months. Both squares were then found to be coated with grey tin, the one that had suffered bombardment more so than the other. The interior, and particularly the top, of the compartment containing the radium was coated with lead carbonate. Probably the rays had ionised the lead and rendered it more active to the moist carbon dioxide in the air. (The ends of the box were left open.)

A solution of hydrogen peroxide, 4·832 grams per litre, was submitted to the action of the radium in the dark, and the amount of the decomposition was measured by the increased pressure. The peroxide solution alone, or in the presence of lead nitrate, did not decompose, but when influenced by the radium rays decomposition ensued, and more rapidly when lead nitrate was present; the pressure of the oxygen at first increased and then showed a decrease, due to the formation of ozone.

The effect of radium on chloroform is to increase its ionisation, so that an opalescence is more rapidly produced with silver nitrate.

A saturated aqueous solution of amygdalin, submitted to the action of radium for four to ten days, did not contain dextrose or hydrogen cyanide. When a saturated solution of amygdalin is boiled with a few drops of Fehling's solution, the blue colour almost disappears, and a bluish-white, gelatinous precipitate (copper amygdalate ?) is formed; the change is more complete with amygdalin that has been submitted to the action of radium. Two identical solutions containing amygdalin and hydrochloric acid, one of which had been submitted to the action of radium, were examined for dextrose. In the one solution the amount of dextrose increased with time and remained constant; in the other, which had suffered bombardment, the dextrose reached a maximum and then decreased, showing that the radium caused it to change into some new compound.

The glass tube containing the radium bromide had been kept for a year in a hollow brass tube. On the surface of the brass a grey deposit was formed, which contained copper, but not zinc or lead, and was probably copper oxide.

Amygdalin may be detected by boiling its solution with a few drops of Fehling's solution, whereby ammonia is evolved. C. S.

Radioactive Products Present in the Atmosphere. W. Wilson (*Phil. Mag.*, 1909, [vi], 17, 321—325).—The radioactive deposit collected by an exposed wire charged to a high negative potential was found by Blanc in Rome to consist of 60—70% of thorium deposit and the remainder radium deposit. A wire exposed in Manchester gathered an active deposit containing on the average 62% of thorium product. It is calculated from the known radioactive constants of the two deposits that air contains 3700 times as much radium as thorium emanation. The ratio given by Dadourian (Abstr., 1908, ii, 453), which is greatly in excess of this figure, is shown to be wrongly calculated. It appears, however, that American air contains relatively less thorium emanation than European air. The author computes that the earth's crust contains 1·42 times as many disintegrating atoms of thorium as of radium, and assuming that uranium is the parent substance of radium, there is about seven times as much thorium as uranium, that is, 10^{-6} gram thorium per c.c. of the earth's crust. R. J. C.

Radioactive Behaviour of the Water of Gratz and its Environs. Albert Wellik (*Monatsh.*, 1909, 30, 89—124).—All the eighty-one samples of spring and well waters from the neighbourhood of Gratz examined by the author contained radioactive emanation. The activity often changes considerably in passing from one spring to another quite close, and seems to increase with the geological age of the rocks. To what extent the activities of the wells remain constant is unknown; variations may be produced by meteorological influences, such as change of barometric pressure, rainfall, etc. The emanation of all the wells dies away according to an exponential law, the period being identical with that corresponding with radium emanation; the law and the period are the same in water as in air. The curves of the induced activity agree well both with the corresponding curves obtained by Curie for radium and with Rutherford's theoretical formula for radium induction; in the case of two of the wells, these curves seem to indicate the presence of thorium.

Many of the waters exhibit a not inconsiderable residual activity, pointing to the presence of dissolved radium salt in very small amount. T. H. P.

Some Properties of the Radium Emanation. Ernest Rutherford (*Mem. Manchester Phil. Soc.*, 1908—09, 53, No. 11, 1—2). —A comparatively small amount of radium emanation is absorbed by cocoanut charcoal at ordinary temperatures. One gram of charcoal absorbs 0·03 cubic mm. emanation at +10° and 0·06 cubic mm. at −40°. R. J. C.

Metallic Radiation. Erik Buch Andersen (*Physikal. Zeitsch.*, 1909, **10**, 54—57. Compare Russell, Abstr., 1898, ii, 287; 1899, ii, 720; Saeland, Abstr., 1908, ii, 789).—A summary is given of observations relating to the photographic activity of metals. The activity is supposed to be connected with the oxidation of the metals, which in the process emit a radiation of very small penetrating power. The active rays are capable of converting oxygen into ozone, which accounts for the observed liberation of iodine from potassium iodide. H. M. D.

Nature of the α-Particle. Ernest Rutherford and T. Royds (*Phil. Mag.*, 1909, [vi], **17**, 281—286; *Mem. Manchester Phil. Soc.*, 1908, **53**, No. 1, 1—3. Compare Rutherford and Geiger, Abstr., 1908, ii, 794; Dewar, Abstr., 1908, ii, 921).—In order to prove that an α-particle consists of an atom of helium plus a positive charge, the purified emanation from 0·12 gram of radium was compressed into a capillary tube with walls 0·01 mm. thick. This capillary tube was known to be impermeable to helium, but the α-particle and also radium-*A* and radium-*C* could pass through it into a stout outer tube, where the spectrum could be examined. Although after twenty-four hours no trace of helium was detected, the spectrum gradually developed until, after six days, all the lines of helium could be seen. This helium must have been produced from α-particles which, after traversing the glass, had slowly lost their charge.

It was supposed that the α-particles were projected into the glass of the outer tube and only slowly liberated as helium. This hypothesis was confirmed by placing a cylinder of lead foil, free from helium, round the capillary tube containing the emanation. Whether the lead was enclosed in a vacuous tube or surrounded by air during its bombardment by the α-particles, the spectrum of helium could be detected in the gas which came out of it in a few hours. R. J. C.

The Range of the α-Rays. William Duane (*Ann. Physik*, 1909, [iv], **28**, 443—444. Compare Abstr., 1908, ii, 553).—The author showed previously that the charge of the α-particles and their ionising effect are stopped by practically the same thickness of air. This conclusion was criticised by Aschkinass (Abstr., 1908, ii, 920) on the ground that the two series of measurements were not carried out under the same conditions. Reasons are now given to show that the experimental method used yields correct results. H. M. D.

α-Rays of Radium-*B* and Atmospheric Radioactivity. Frederic A. Harvey (*Physikal. Zeitsch.*, 1909, **10**, 46—48).—The active deposit collected on a negatively charged wire suspended in the atmosphere emits at first some very easily absorbed rays. These have been found to be due to radium-*B*. The range of these α-rays in air under normal conditions is 2·6—3·0 mm.

Further observations on wires which had been connected with a negative potential of 5000 volts, and exposed for periods of three to twenty-four hours, indicate that the half-decay period of the active deposit is by no means constant. In twenty-six experiments made under different atmospheric conditions, this period was found to vary from thirty-four minutes to five and two-thirds hours. The variation is attributed to differences in the proportion of induced thorium activity in the collected deposit. The potential of the charged wire influences this proportion. In two experiments under the same atmospheric conditions, the exposed wire was charged to 2000 and 4000 volts; the proportions of induced thorium activity were respectively 11·6 and 7·2%. The relative amount of thorium activity also depends on barometric fluctuations. In two perfectly similar experiments on the same day, during one of which the barometer was rising, and during the other slowly falling, the proportions of induced thorium activity were found to be respectively 17·8 and 26·5%. H. M. D.

The Number and the Absorption by Matter of the β-Particles emitted by Radium. Walter Makower (*Phil. Mag.*, 1909, [vi], 17, 171—180).—The number of β-particles expelled by one gram of radium per second has been re-determined, the experimental arrangement adopted being designed to obviate errors arising from secondary radiation efforts. Radium emanation was used instead of radium, the emanation being contained in a very thin-walled capillary glass tube. This tube, covered with aluminium leaf to render it conducting, was suspended in the axis of a glass cylinder, silvered on the inside, and connected with a pump, by means of which it could be exhausted as perfectly as possible. An insulated brass cylinder surrounding the emanation tube was connected with a quadrant electrometer, whilst the emanation tube itself could be connected with a battery of accumulators. The β-rays which reach the brass cylinder under the conditions of the experiment consist chiefly of the rays from radium-C, together with a small proportion of the rays from radium-B. A correction is introduced for the absorption of the former by the glass of the emanation tube, and the result is then obtained that the number of β-particles emitted per second by the radium-C in equilibrium with one gram of radium is $5·0 \times 10^{-10}$. When the β-rays are absorbed by glass, the electric charge carried by these remains in the glass, indicating that the rays are actually stopped and not merely scattered. H. M. D.

Absorption of the Different Types of β-Rays, together with a Study of the Secondary Rays excited by them. V. E. Pound (*Phil. Mag.*, 1909, [iv], 17, 126—153).—The author has investigated the secondary radiation emitted from the front and back of metal plates when these are subjected to the action of γ-rays and of different types of β-rays. By means of a magnetic field a pencil of the required type of radiation could be deflected into an ionisation chamber.

The observations show that the β-rays from radium and its disintegration products are unable to produce ionisation effects on the far side of plates of aluminium, tin, and lead of thickness 7, 2·5, and 0·9 mm. respectively.

The maximum secondary radiations from the front side of plates of these metals are obtained when the thicknesses of the plates are respectively 0·4, 0·24, and 0·16 mm. The penetrability of this secondary radiation excited by the β-rays increases with the density of the metal acting as reflector.

Observations with γ-rays show that the transmitted secondary rays from lead and tin are more penetrating than those from aluminium. It is also found that the ionisation due to transmitted secondary radiation, when β-rays are allowed to pass through very thin sheets of aluminium, is greater than the ionisation which would have been caused by the absorbed primary rays. H. M. D.

Absorption of β-Rays by Liquids. Norman Campbell (*Phil. Mag.*, 1909, [vi], 17, 180—190).—The absorption of the β-rays of uranium by water and certain aqueous solutions has been examined. Experiments with layers of water of different thicknesses, and with varying quantities of water poured on to filter-paper contained in the absorption tray, show that in neither case is the absorption strictly exponential. The values of the coefficient also differ in the two cases, and the author doubts whether liquids possess a true absorption-coefficient defined as a quantity occurring in an exponential equation.

The relationship between the values of λ/ρ (λ being the absorption coefficient and ρ the density) for solutions of sodium iodide, potassium nitrate, and potassium carbonate and the corresponding values for the solvent and the respective solutes is not a linear one. The deviations from the linear relationship are quite different in the various solutions examined. H. M. D.

Effect of Pressure on the Natural Ionisation in a Closed Vessel, and the Ionisation produced by the γ-Rays. W. Wilson (*Phil. Mag.*, 1909, [vi], 17, 216—225).—The closed vessel containing the electroscope consisted of a cylindrical iron vessel having walls 1·5 inches thick and an iron water-jacket about 0·5 inch in thickness. The observations were made with pressures reaching up to 45 atmospheres.

Under the influence of γ-rays the ionisation increases with the pressure of the contained air, although not so rapidly. This is due to the fact the secondary rays from the sides of the vessel contribute considerably to the ionisation. From the equation which represents the ionisation-pressure curve, it is calculated that the ratio of the ionisation due to the secondary and primary rays at atmospheric pressure is 6·6.

The curve connecting the natural ionisation with the pressure of the air in the vessel is a straight line, which curves over towards the pressure axis at low pressures. The form of the curve suggests that the ionisation is the sum of two effects. One of these is independent of the pressure, and is due to radiations from the sides of the vessel. The second effect is proportional to the pressure, and is due chiefly to an emanation mixed with the air, and to a smaller extent to a very penetrating form of radiation. The emanation, if it is one of those already known, must be that of radium. H. M. D.

Grating Spectrum of Radium Emanation. T. Royds (*Phil. Mag.*, 1909, [vi], 17, 202—204. Compare Rutherford and Royds, Abstr., 1908, ii, 787).—Three photographs of the spectrum have been obtained using a concave grating 3·5 inches wide, ruled with 15,000 lines to the inch, the radius of curvature being 1 metre. About thirty-five of the more intense lines previously obtained in the prism spectrum are found on the photographs, together with four new lines which lie further in the ultra-violet region. The wave-lengths of the lines are recorded, and are in good agreement with the prism spectrum measurements. H. M. D.

New Phenomenon in the Activation with Actinium. Otto Hahn (*Physikal. Zeitsch.*, 1909, 10, 81—88).—The active deposit which is deposited on a negatively-charged electrode exposed to the action of actinium preparations consists of three rapidly-decaying products, actinium-*A*, -*B*, and -*C*, and of a small quantity of a much more slowly decaying product. The amount of the slow-decay product varies considerably with the conditions of the activation, but the activity due to it may amount to as much as 0·25% of the total original activity.

Examination of the slow-decay product has shown that it consists of actinium-*X*. The deposition of this on the negative electrode is not due to its volatility or to the formation of a short-lived emanation between radio-actinium and actinium-*X*, but is a consequence of the explosive nature of the decomposition of the radio-actinium atoms. Some of the resulting actinium-*X* atoms are forced out from the molecular aggregate in the explosion process, and under the influence of the electric field are carried to the negative electrode. In accordance with this, it is found that the residual activity of the active deposit diminishes when the distance between the negative electrode and the actinium preparation is increased. When the electrode is uncharged or is charged positively, the active deposit shows practically no residual activity.

In agreement with the explanation given, it has been found that pure actinium-*X* has no residual activity, whilst the residual activity of radio-actinium is independent of the proportion of actinium-*X* which is mixed with it. H. M. D.

Radiation of Uranium-*X*. Heinrich W. Schmidt (*Physikal. Zeitsch.*, 1909, 10, 6—16).—A method of separating uranium-*X* is described by means of which a product is obtained the specific activity of which is much greater than those yielded by previous methods. The active substance is first separated from acetone solution by the addition of freshly-precipitated ferric hydroxide according to Moore and Schlundt's method; the active hydroxide is then dissolved in hydrochloric acid, a little barium chloride added, and the barium precipitated by the addition of dilute sulphuric acid. Although all the uranium-*X* is not precipitated with the barium sulphate, the activity of this is about 5000 times that of the original uranium nitrate.

With the active preparation, measurements of the absorption and of the deviation in a magnetic field have been made for both the hard and soft β-rays.

From the magnetic experiments with the hard β-rays, the velocity of these is found to be $2{\cdot}76 \times 10^{10}$ cms. per sec., and the ratio of the charge to the mass $0{\cdot}67 \times 10^7$. The observations with the soft rays indicate definitely that these also are negatively charged.

The absorption curves for the hard rays are found to depend very largely on the experimental arrangement. The observations can only be partly explained by the assumption that the rays are unevenly distributed in the absorbing medium or that the velocity of the particles diminishes somewhat as the length of path traversed increases. The proportion of β-rays reflected from a thick plate is greater for the hard than for the soft rays; a minimum value for the reflected radiation can be calculated.

The soft β-rays are absorbed by aluminium according to an exponential law. H. M. D.

Formation of Helium from Uranium. Frederick Soddy (*Physikal. Zeitsch.*, 1909, 10, 41—42).—The experiments have in part been described previously (Abstr., 1908, ii, 921). Further observations with a larger quantity of uranium nitrate containing 1850 grams of uranium confirm the previous estimate that the rate of production of helium is approximately $2 \times 10^{-12}(\text{year})^{-1}$. Experiments have been commenced with sylvine, which, according to Strutt, contains relatively large quantities of helium. If helium is produced at all, its rate of formation is less than $2{\cdot}5 \times 10^{-12}(\text{year})^{-1}$. H. M. D.

Electrically Charged Centres of Small Mobility in Gases. Maurice de Broglie (*Ann. Chim. Phys.*, 1909, [viii], 16, 1—69).—A detailed account of work already published (compare Abstr., 1907, ii, 664; 1908, ii, 344). M. A. W.

[Calculation of the Ratio of the Electric Charge to the Mass of the Molecule of Mercury Vapour.] Robert Pohl (*Physikal. Zeitsch.*, 1909, 10, 90).—The author points out that Fürstenau's calculation of e/m for mercury vapour (compare this vol., ii, 12) does not represent a new method for obtaining this ratio. Analysis of the method of calculation shows that what is proved is the validity of the equation $C_v = 3{\cdot}0$ for monatomic gases, C_v being the molecular heat at constant volume. H. M. D.

The Hardness and Electrical Resistance of Solid Solutions of Metals. Carl Benedicks (*Zeitsch. anorg. Chem.*, 1909, 61, 181—186. Compare Kurnakoff and Schemtschuschny, Abstr., 1908, i, 932).—The author claims priority for certain conclusions as to he hardness and electrical resistance of solid solutions. For solid metallic solutions of the type AB^{0-n}, the resistance is a linear unction of the concentration of B up to considerable values of n. The conductivity does not show this proportionality. For aggregates f two kinds of crystals, however, the conductivity shows a greater egularity than the resistance, the relation being generally a linear ne. C. H. D.

Electrical Conductivity of Pure Hexane. GEORGE JAFFÉ (*Ann. Physik*, 1909, [iv], 28, 326—370).—Experiments have been made to ascertain whether a liquid insulator has a specific electrical conducting power. Hexane was chosen for examination because of the relative ease with which electrically conducting impurities can be removed from it. The apparatus was similar to that used in the investigation of the conducting power of gases. Synthetic hexane and hexane from light petroleum were examined, the method of purification consisting in repeated distillation and prolonged subjection to the influence of the current.

It has been found that hexane, purified in this way, has a definite minimum conducting power which is constant for different samples of hexane. For sufficiently high potential differences (above 200 volts per cm.), the current is independent of the potential, indicating that the conductivity is not due to electrolytic dissociation of the hexane. Under the particular conditions of the experiment, the conductivity was found to be 12·6 times as large as that of air, corresponding with the production of 216 ions per c.c. per second. These facts show that hexane behaves like a very dense gas.

The conductivity is independent of the temperature, but varies with the nature of the material of the vessel in which the hexane is contained. In a brass cylinder, two-thirds of the conductivity is due to the influence of external radiation, the remainder to the action of rays emitted by the cylinder. When the external rays are cut off by surrounding the cylinder with a thick block of lead, the conductivity of the hexane experiences a corresponding diminution. The absorption coefficient of the external radiation is 0·458 cm.^{-1}, which value agrees with that for hard γ-rays. The conductivity is unipolar in character, and this is attributed to the emission of β-rays by the material of the containing cylinder.

The dependence of the conductivity on the material of the containing vessel was investigated by observations in vessels of aluminium, silver, copper, and platinum. The conductivity due to the rays emitted by these metals diminishes in the order in which they are written.

Experiments with heptane and light petroleum show that these have a limiting minimum conductivity nearly equal to that of hexane.

H. M. D.

Dissociation Equilibrium of Binary Electrolytes. ALBERT REYCHLER (*J. Chim. Phys.*, 1909, 7, 58—67).—General considerations on electrolytic dissociation on the basis of the author's views on "mobile ions" (Abstr., 1904, ii, 534).

G. S.

Production of Permanent Magnets from Specimens of nearly Pure Copper. J. G. GRAY and A. D. ROSS (*Physikal. Zeitsch.*, 1909, 10, 59—61).—Samples of nearly pure copper were subjected to various kinds of treatment and then placed between the poles of an electro-magnet giving a field of about 3000 *C.G.S.*-units. The samples were afterwards examined for permanent magnetism by means of a sensitive magnetometer.

No residual magnetism could be detected when a sample of copper of high conductivity was subjected to the action of the magnetic field at the ordinary temperature or at −190°. The same result was obtained when the sample was hammered whilst under the influence of the field. After having been heated to a bright red heat and slowly cooled, the result was the same, but after rapid cooling by immersion in water considerable residual magnetism was found.

Electrolytic copper containing less than 0·04% iron gave similar results. Moreover, when the rapidly cooled electrolytic copper was magnetised at −190°, the residual magnetism was about twice as large as that found when the same sample was magnetised at the ordinary temperature. When such a copper magnet was heated to 100° and 400° and then slowly cooled, the residual magnetism fell respectively to 60 and 30% of the original amount, and after heating to 600° it had completely disappeared.

A sample of very pure electrolytic copper, which was specially prepared for these experiments, showed no trace of permanent magnetism after heating to a red heat and rapid cooling. The last experiment indicates that the magnetic proportions of ordinary electrolytic copper are due to the small traces of iron present. The observed effects are, however, much greater than correspond with the amount of iron present, and, as an explanation of the facts, the authors suggest that a magnetic compound of iron and copper is formed. H. M. D.

Thermal Effect of the Magnetic Transformation of Nickel and Cobalt. Iwan I. Shukoff (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1748—1752).—The author has carried out experiments to ascertain whether the loss of magnetic properties by nickel at 340° and by cobalt at about 1000° is accompanied by any heat effect.

First of all, the *E.M.F.* of platinum-nickel and platinum-cobalt thermocouples were measured against those of a platinum-platinum-rhodium couple at different temperatures, all the ends of the thermocouples being soldered by means of gold. The curves obtained, based on a large number of observations, change their character at about the temperatures at which the two metals lose their magnetic properties.

The electrical conductivity of cobalt has not been investigated at temperatures as high as its magnetic transformation point; but from the data for nickel, it may be assumed that the conductivity curve for cobalt should exhibit a break in the temperature-interval 900—1000°. There is hence a close connexion between magnetic properties, electrical conductivity, and thermo-electric properties. In order to ascertain whether these various properties can undergo sudden change unaccompanied by a heat effect, the cooling curves of nickel and cobalt were investigated by Roberts-Austen's differential method, the difference of temperature being measured between a piece of platinum and a piece of nickel or cobalt cooling under identical conditions. In the case of cobalt, a slight but distinct heat effect was observed at 985°, but for nickel there was no indication of any such effect between 600° and 180°. With nickel, then, as the magnetic properties, electrical conductivity, and thermo-electric properties may change suddenly without any accompanying heat effect, these properties must depend on the internal structure of the atom and not on a molecular transformation, such as a change from one allotropic modification to another.

T. H. P.

Two New Forms of Laboratory Electric Furnace. K. Friedrich (*Metallurgie*, 1908, 5, 703—705).—A small furnace giving rapid heating has an iridium tube, open at both ends, 120 mm. long, 19·7 mm. diam., and 0·4 mm. thick. A fire-clay cylinder with a mica window for observation protects against loss of heat. Such a furnace can be raised to 1600° in half a minute, using 900—1000 amperes at 3 volts.

For maintaining a uniform and constant temperature, a cylinder of fire-resisting material is used in which a platinum spiral is embedded. Such a furnace can be raised to 1200—1300° in thirty minutes with a current of 2—2·5 amperes at 220 volts.

C. H. D.

A Method of Calculating the Number of Degrees of Freedom of a Molecule among which the Partition of Energy is Governed by the Principal Temperature. H. Bateman (*Mem. Manchester Phil. Soc.*, 1908–1909, 53, No. III, 1—9).—Boltzmann has formulated a law expressing the ratio of the specific heats of a gas in terms of the number of degrees of freedom of the molecule the energy of which is governed by the principal temperature. The author assumes that valency is a degree of freedom fulfilling the condition mentioned, and hence that each atom possesses a number of degrees of freedom represented by three + its valency under the circumstances. A molecule has all the degrees of freedom of its constituent atoms minus the number of conditions which must be satisfied in order that the geometrical configuration may remain permanent.

This theorem leads to a set of simple rules, by the aid of which the ratios of specific heats of eighteen elements and compounds are calculated with surprising approximation to the experimental values.

R. J. C.

Explanation of the Negative Coefficient of Expansion of Silver Iodide. Grinnell Jones (*J. Amer. Chem. Soc.*, 1909, 31, 191—200. Compare this vol., ii, 214).—Fizeau (*Ann. Phys. Chem.*, 1867, 132, 292) determined the coefficient of expansion of three different varieties of silver iodide, and found it to be negative in each case. This fact has now been studied in the light of Richards' hypothesis of compressible atoms. It is shown that changes in the volume of substances with increasing temperature are due to three causes: (1) an increase in the space between the molecules on account of the increased violence of the molecular vibrations; (2) an increase in the volume of the molecules due to a decrease in cohesion; and (3) a change in the volume of the molecules due to a change in the chemical attraction of the atoms for each other. A study has been made of the free energy of formation of silver iodide and also of silver chloride and bromide. The results show that in the case of silver iodide the affinity of the silver and iodine increases with rising temperature, which should tend to produce a diminution in volume, and this is in agreement with the fact that silver iodide actually contracts when heated.

It is pointed out that, in general, substances with a low coefficient of expansion are stable at high temperatures, whilst substances with a high coefficient of expansion are unstable. E. G.

Supercooling and Chemical Constitution. KARL DRUCKER (*Verh. deut. Naturforsch. Aerzte.*, 1907, ii, 92—94).—Small amounts (1—2 c.c.) of a number of typical substances were allowed to cool very gradually, and the temperatures at which solidification took place noted. Among the substances examined, urethane and bromoform showed very little tendency to supercooling; for benzene, ethylene dibromide, and *p*-xylene the tendency was greater, and acetophenone, nitrobenzene, acetic acid, and anethole showed considerable supercooling. The tendency to supercooling seems to be greatest for those substances showing considerable change of complexity with alteration of temperature. Only in the case of formamide did the supercooling appear to be influenced by the degree of purity of the substance.

G. S.

Volatility of Arsenic and Thallium in Vacuum and a Method of Calculating the Boiling Points of Metals. FRIEDRICH KRAFFT and A. KNOCKE (*Ber.*, 1909, 42, 202—206).—The relationship existing between the temperature at which a metal commences to volatilise and its boiling point in a complete vacuum and its boiling point under a pressure of 760 mm. (compare Krafft, Abstr., 1905, ii, 144) also exists between the temperatures at which substances sublime. It is shown that arsenic in a vacuum commences to volatilise at 96°, and sublimes rapidly at the constant temperature of 325°; under 760 mm. pressure it sublimes constantly at 554°. The difference between the first and second values and the second and third values is 229°. Consequently, if two of these values are known, t is possible to calculate the third; thus, thallium in a complete vacuum commences to volatilise at 174° and boils constantly at 818°; the difference is 644°: consequently, the boiling point of thallium under a pressure of 760 mm. must be about 1462°. W. H. G.

Volatilisation of Difficultly Volatile Metals, particularly Platinum and Iron, in Evacuated Glass Vessels. A. KNOCKE *Ber.*, 1909, 42, 206—210. Compare preceding abstract).—An nvestigation on the volatility of various metals in a complete vacuum. The values given are the lowest temperatures at which volatilisation f the metal could be detected: calcium, 398°; strontium, 375°; arium, 355°; magnesium, 415°; platinum, 540°; iridium, 660°; alladium, 735°; iron, 755°; cobalt, 640° and nickel, about 750°.

W. H. G.

Volatilisation and Sublimation at Minimum Temperatures in a Vacuum, particularly of High Molecular Carbon Compounds. CHR. J. HANSEN (*Ber.*, 1909, 42, 210—214).—An investigation on the volatility of certain organic compounds in a vacuum in which the cathode light disappears. The following are the lowest temperatures at which volatilisation of the substance can be detected: lauric acid, 22°; myristic acid, 27°; palmitic acid, 32°; stearic acid, 38°; laurone, 40°; myristone, 46°; palmitone, 52·7°; stearone, 58°, and dotriacontane, 63°. In a complete vacuum, phenanthrene loses 12% of its weight at about 20° in twelve hours; anthracene loses 1% at 35° in six hours; phenanthraquinone loses 0·15% at 36° in ten hours; anthraquinone loses 0·08% at 36° in ten hours; retene loses 2·2% at 36° in fourteen hours; chrysene is volatile at 60°, and alizarin volatilises at 38—39°, but not at 36°. Maleic acid and phthalic acid sublime undecomposed in a complete vacuum at about 80° and 115—117° respectively. W. H. G.

Molecular Weights of Inorganic Salts in Methyl Acetate. JOHANNES SCHROEDER and HANS STEINER (*J. pr. Chem.*, 1909, [ii], 79, 49—65).—An investigation on the state of inorganic salts dissolved in methyl acetate.

The molecular elevation of the boiling point of methyl acetate, using naphthalene, diphenylamine, benzil, and camphor as normal substances, was found to be 20·61, from which is calculated the latent heat of vaporisation, $w = 105{\cdot}3$ (compare Gernhardt and Beckmann, Abstr., 1896, ii, 236).

The following salts were investigated: the thiocyanates of potassium and sodium; the chloride, bromide, iodide, and thiocyanate of lithium, calcium nitrate, barium iodide, cobaltous bromide, zinc nitrate, cadmium iodide, cuprous chloride and bromide, mercuric chloride, bromide, iodide and nitrate, stannous chloride, and bismuth chloride; their solubilities in the boiling solvent were estimated, and, without exception, the molecular weights derived from the elevation of the boiling point of the solution were much smaller than the theoretical values; the conclusion is drawn, therefore, that these salts, particularly in dilute solutions, are largely dissociated into their respective ions.

The laws which are found to apply to the dissociation phenomena of salts in aqueous solutions are only in part applicable to solutions in methyl acetate. The alteration in the degree of dissociation of the solute which accompanies the change of concentration in this solvent follows a different course to that of aqueous solutions. It is not improbable that some of these irregularities are due to the difficulty of obtaining certain salts in an anhydrous state. W. H. G.

Thermochemistry of Phosphorus. JOHN C. THOMLINSON (*Chem. News*, 1909, 99, 40).—In a previous communication (Abstr., 1907, ii, 153) the conclusion was drawn that phosphorus behaving as a quadrivalent element would have a heat of combination = 32·025 cals., and oxygen as a univalent element = 71·228 cals., or when bivalent, 52·545 cals. Employing these values, formulæ have been arrived at which give a theoretical heat of combustion in agreement with that found, and are intended to express the whole reaction of combustion of a particular variety of phosphorus with oxygen. J. V. E.

Thermochemical Investigations of Organic Compounds: Aromatic Series. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1692—1715. Compare this vol., ii, 23).—In continuation of his previous work on aliphatic compounds, the author analyses the thermochemical data for aromatic hydrocarbons and for members of all classes of oxygen-containing aromatic compounds. The general results confirm those arrived at from a study of the aliphatic compounds, and lead to the following additional conclusions.

In benzene, as in all mono- and polycyclic derivatives of it, there exists complete saturation of the atomic linkings, since, quite independently of any increase of the benzene structure, the heat required for the complete rupture of the nucleus is equal to $9y + 6x$, where x and y represent the linkings C–H and C–C, and have the same magnitudes as in methane and ethane. The degrees of saturation of the linking C–O in acids, alcohols, ethers, aldehydes, ketones, and quinones have been determined. The heat of formation of the linking C–O in the ether, $CH_3{\cdot}O{\cdot}CH_3$, is 6 Cals. greater than the heat of formation of the same linking in the alcohol, $CH_3{\cdot}OH$.

The heats of formation of unsaturated linkings increased in any class of compounds with the molecular weight, and also increase in passing from a normal to an iso-structure. In the different classes of compounds investigated, the heats of formation of an unsaturated linking depends only on the atoms and groups surrounding it. Thus the replacement of the hydrogen in the hydroxyl group of an alcohol or an acid causes a considerable increase in the heats of formation of adjacent unsaturated linkings. T. H. P.

Alteration of the Transition Temperature of Glauber's Salt by a Third Substance. Eugen von Biron and S. P. Malschevsky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1619—1635).—The authors have determined the changes produced in the transition temperature of decahydrated sodium sulphate and in the solubility of the salt by the presence in various concentrations of the electrolytes, sodium chloride, bromide, iodide, and chromate, and of the non-electrolytes, dextrose and alcohol.

The temperature of transition of the pure decahydrate was found to be 32·45° (compare Richards and Wells, Abstr., 1903, ii, 411), solubility determinations at this temperature giving results varying from 49·37 to 49·76 grams of anhydrous sodium sulphate per 100 grams of water, the mean being 49·59.

The molecular depressions of the transition temperature produced by the electrolytes are very nearly the same as those caused by dextrose. The depressions due to ethyl alcohol are considerably less than the others, as would be expected from the fact that the alcohol is associated in the liquid state. The depressions caused by the electrolytes employed increase with the concentration, but in the case of dextrose such increase is almost negligible. This difference is readily explainable as due to the electrolytic dissociation of the electrolytes. The molecular depressions produced by equimolecular solutions of sodium chloride, bromide, and iodide diminish markedly in the order NaCl, NaBr, NaI. The solubility of sodium sulphate in equimolecular solutions of these three salts also diminishes in the same series, but this fact is independent of the electrolytic dissociation of the salts. The theory of these various phenomena is discussed. T. H. P.

Thermodynamics of Binary Mixed Liquids. Emil Bose (*Zeitsch. physikal. Chem.*, 1909, 65, 458—485).—Part of the results described in this paper have already been published (Abstr., 1907, ii, 435; 1908, ii, 84).

A complicated formula is deduced connecting the heat of admixture of two liquids with the composition of the mixture. The formula is applied to the experimented data obtained for the systems formed by mixing water with methyl, ethyl, and propyl alcohols respectively (*loc. cit.*), and it is shown that in all three cases there are regular and periodic differences between the observed and calculated values for the heat given out. The deviations are ascribed to the fact that in all three systems both components are associated. G. S.

Compressibilities of the Chlorides, Bromides, and Iodides of Sodium, Potassium, Silver, and Thallium. Theodore W. Richards and Grinnell Jones (*J. Amer. Chem. Soc.*, 1909, 31, 158—191).—Richards (Abstr., 1902, ii, 305; 1903, ii, 132; 1904, ii, 704) in a study of the significance of changing atomic volume has pointed out that the volumes of both solids and liquids probably depend on both the chemical and cohesive forces existing within them. In order to ascertain the connexion between the internal pressures and the external volumes of substances, it is necessary to know the compressibilities of both elements and compounds through a wide range of pressure. The compressibilities of a number of substances have already been determined (Abstr., 1904, ii, 384; 1907, ii, 858).

In the present paper, the compressibilities of the chlorides, bromides, and iodides of sodium, potassium, silver, and thallium have been determined by a slight modification of the method used in the earlier work. The results obtained between 100 and 500 megabars (the megabar being the pressure of a megadyne per sq. cm.) are as follows: sodium chloride, $4{\cdot}1 \times 10^{-6}$; sodium bromide, $5{\cdot}1 \times 10^{-6}$; sodium iodide, $6{\cdot}9 \times 10^{-6}$; potassium chloride, $5{\cdot}0 \times 10^{-6}$; potassium bromide, $6{\cdot}2 \times 10^{-6}$; potassium iodide, $8{\cdot}6 \times 10^{-6}$; silver chloride, $2{\cdot}2 \times 10^{-6}$; silver bromide, $2{\cdot}6 \times 10^{-6}$; silver iodide, $3{\cdot}9 \times 10^{-6}$; thallous chloride, $4{\cdot}7 \times 10^{-6}$; thallous bromide, $5{\cdot}1 \times 10^{-6}$; thallous iodide, $6{\cdot}7 \times 10^{-6}$.

The relative values of these compressibilities have been correlated with the volatility, surface tension, internal stress, and heat of formation of the salts, and also with the compressibility of the elements and the contraction which occurs during the formation of the salts from their elements.

The results of this work support the hypothesis which has been put forward with regard to the volumes of liquids and solids, and afford further evidence of the significance of changing atomic volume. E. G.

Relation between the Compositions of the Vapour and Solution with Binary Mixtures exhibiting a Maximum or Minimum [Pressure]. A. E. Makovetzki (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1715—1735).—Starting from the principle of dynamic equilibrium, the author deduces that, for binary mixtures of liquids exhibiting a maximum or minimum, the relation between the concentrations of the two components in the liquid (x_2 and $1-x_2$) and gaseous (x_1 and $1-x_1$) states is expressed by the formula $x_2/(1-x_2) = Kx_1/(1-x_1)$, that is, the coefficients of distribution of the components in the two states bear to one another a constant relation. The above expression confirms and is a simplified form of van der Waals' equation: $x_2/(1-x_2) = e^{d\mu_1/dx_1}x_1/(1-x_1)$. The results obtained on examining mixtures of the ether of ethylene glycol and water, carbon disulphide and acetone, carbon disulphide and methylal, ethyl iodide and ethyl acetate, and acetone and chloroform, are in good agreement with those calculated on the basis of the above formula.

The work of van der Waals, Margules, Gibbs, von Zawidzki (Abstr., 1901, ii, 6), Konowaloff (Abstr., 1907, ii, 602), and Dolezalek (this vol., ii, 22) is discussed. T. H. P.

Measurement of the Surface-tension and other Physical Constants of Acetic Acid-Water Mixtures. Leo Grunmach (*Ann. Physik*, 1909, [iv], 28, 217—257).—The surface-tension, refractive index, and electrical conductivity of mixtures of acetic acid and water have been measured. The values of the surface-tension, obtained by determining the wave-lengths of capillary waves generated on the surface of the liquid mixtures, decrease continuously as the percentage of acetic acid in the mixture increases. There is therefore no apparent connexion between the surface-tension and the viscosity, for the viscosity increases with the acetic acid concentration to a maximum which corresponds approximately with the mixture of maximum contraction and then decreases.

The refractive index increases with the proportion of acetic acid in the mixture, attains a maximum for a mixture containing 87% of this, and then decreases. The composition of this mixture of maximum refractive index differs from that of the mixture corresponding with maximum contraction and maximum density.

The electrical conductivity measurements relate to mixtures containing from 43·9 to 99·6% of acetic acid. The specific conductivity diminishes continuously with increasing proportion of acetic acid, and there is no evidence of any abnormal change at the concentration which corresponds with the maximum contraction.

H. M. D.

Anomalies in the Viscosity of Anisotropic Liquids in a Condition of Hydraulic Flow. Emil Bose (*Physikal. Zeitsch.*, 1909, 10, 32—36).—Measurements have been made of the times of flow of anisaldazine through a capillary tube at temperatures in the neighbourhood of the clearing temperature and under different hydrostatic pressures. When, as a result of an increase in the hydrostatic driving pressure, the Poiseuille condition of flow is replaced by the hydraulic condition, the anomalies exhibited by the viscosity of the anisotropic liquid are found to diminish. The observations support the author's view that anisotropic liquids represent molecular aggregates in which the molecules tend to move by preference in the direction of the long axes of the molecules. H. M. D.

Laws of the Molecular- and Viscosity-Diffusion of Gases through Tubes. Martin Knudsen (*Ann. Physik*, 1909, [iv], 28, 75—130).—The author has determined the rate at which hydrogen, oxygen, and carbon dioxide pass through capillary tubes under different conditions. By alteration of the gas pressure the ratio between the mean free path of the molecules and the radius of the capillary tube was made to vary between very wide limits. McLeod gauges, connected with two gas reservoirs on opposite sides of the capillary tube, were used to determine the absolute pressure values as well as the pressure fall.

When the radius of the tube is very small in comparison with the mean free path of the molecules, molecular diffusion takes place at a rate which is proportional to the driving pressure and inversely proportional to the square root of the density of the gas.

When the radius of the tube is not very small or very large in comparison with the mean molecular free path, the rate of passage through the tube is determined partly by molecular diffusion, and partly by a movement regulated by Poiseuille's law. In these circumstances, the quantity of gas which passes through the tube in unit time under the influence of unit fall of pressure decreases at first as the pressure increases, a minimum value being attained when the pressure is still very small, and beyond this the quantity increases uniformly with the pressure. A considerable part of the paper deals with the theory of the phenomenon. H. M. D.

Osmotic Pressure of Sucrose Solutions at 25°. Harmon N. Morse and William W. Holland (*Amer. Chem. J.*, 1909, 41, 1—19. Compare Abstr., 1908, ii, 671, 1019).—With the object of ascertaining the temperature-coefficient of the osmotic pressure, it was decided to measure the pressure of sucrose solutions in concentrations from 0·1 to 1·0 weight-normal at intervals of five degrees from 0° to 30°. Of these, measurements at 10° and 15° have already been recorded (*loc. cit.*), and the authors now publish in customary form the pressure measurements of the usual ten concentrations of solution at 25°. Tables giving a summary of the progress made up to the present time are also appended, from which it is seen that the osmotic pressure is throughout higher than the corresponding gas pressure, the mean ratio being 1·06 : 1 in all cases from 5° to 25°. J. V. E.

Cohesion Pressure (Haftdruck). The Theory of Solutions. Isidor Traube (*Ber.*, 1909, 42, 86—94).—The paper is a summary of the author's work appearing elsewhere (*Verh. Deut. Phys. Ges.*, 1908, 10, 480; and in its physiological relationships (Abstr., 1908, ii, 565).

All forms of energy can be expressed as the product of an intensity and a capacity factor. Against the modern theories of osmotic pressure and electrolytic dissociation, the author levels the reproach that only the capacity factor has been considered. The intensity factor, which he calls the cohesion pressure and which represents the force with which a solute is retained in a solution, has been altogether neglected, although its examination in solutions is as necessary as that of potential in electrochemistry.

Gibbs has proved thermodynamically that a solute which diminishes the surface-tension of a solvent tends to accumulate in the surface layer, and vice versa. This principle is enunciated by the author in the form: the more a solute diminishes or increases the surface-tension of a solvent, so much the smaller or the greater is its cohesion pressure. Accordingly, the difference of the surface-tensions of a solvent and a solution is a measure of the cohesion pressure.

In osmosis, the driving force is the difference of the surface-tension, not the osmotic pressure. If equimolecular aqueous solutions of amyl alcohol and of sugar are separated by a membrane, equilibrium is not established (as it should be by the ordinary theory, since the number of particles on both sides of the membrane is equal), because amyl alcohol, which diminishes greatly the surface-tension of water, has a smaller cohesion pressure than sugar, which increases the surface-tension.

By measuring the surface-tension of salt solutions, the author has been able to arrange ions in the order of their cohesion pressures. There is scarcely a property of solutions for which this order is not wholly or approximately retained. Such properties have been examined as the capacity of hydration, diminution of solubility, compressibility, diminution of vapour pressure, depression of the freezing point, internal friction, mobility and electrical conductivity, diminution of the specific heat, heat of solution, heat of neutralisation, optical activity, specific volume, velocity of reaction, refraction and absorption of light, and valency. Since the internal pressure of most organic liquids is approximately the same, the author states that those organic liquids have the greatest solubility which have the greatest cohesion pressure. This deduction is confirmed without exception.

The relations between surface-tension and partition-coefficients and between surface-tension and adsorption (compare Freundlich, Abstr., 1907, ii, 155) are very briefly referred to. With regard to the vapour pressure of aqueous solutions of volatile, organic substances, the author finds, in conformity with his theory, that the vapour pressure of substances of the same boiling point in aqueous solution is so much the greater the greater their cohesion pressure, and that substances of the same cohesion pressure have vapour pressures so much the greater the lower the boiling point.

Reference must be made to the original paper (*loc. cit.*) for evidence of the following statements.

The approximately equal heats of neutralisation of strong acids and strong bases is a consequence of the fact that the difference between the cohesion pressure of any strong acid and its salt with a given strong base is approximately the same; with regard to weak acids, however, it is found that, in consequence of the small cohesion pressure of, for example, acetic acid, the work necessary to separate acetic acid from its solvent is just so much less than the work in the separation of a strong acid as corresponds with the difference of the work of ionisation.

The greater the cohesion pressure of a substance or its ions the greater is the degree of ionisation.

For organic substances of small cohesion pressure, the square root of the cohesion pressure is proportional to the molecular volume, and therefore to the molecular refraction and to the sum of the valencies (Abstr., 1907, ii, 205); the contraction of the co-volume is, in aqueous solution, proportional to the cohesion pressure.

The whole behaviour of colloids, such as albumin, etc., is explained by the fact that their cohesion pressure in water is practically nil.

The cohesion pressure is an ionising force, and the omission of its consideration in the theory of electrolytic dissociation has led to disastrous results. The theory of Arrhenius, which the author regards as fundamentally erroneous, is concerned only with changes in the capacity factor, that is, with the number of particles in the solution, and does not take into account the fact that changes of the cohesion pressure must play an important rôle. The abnormal behaviour of concentrated solutions is connected with the cohesion pressure.

C. S.

Guldberg and Waage's Law from the Point of View of the Theory of Probabilities. S. Voinitsch-Sjanoschentzky (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1676—1684).—A mathematical paper, in which the author shows that the law of Guldberg and Waage can be deduced by applying the theory of probabilities to the atomic-molecular hypothesis, no further assumptions being required.

T. H. P.

A Three-phase Equilibrium, showing a Pressure Minimum, in the Case of a Dissociating Compound of Two Components. I. Gerard H. Leopold (*Zeitsch. physikal. Chem.*, 1909, **65**, 428—441).—A theoretical paper. The different forms of curve for a three-phase system in which a minimum value for the pressure occurs are discussed and figured. The theoretical conclusions have been tested by experiments with chloral alcoholate and with aniline hydrochloride; the results are to be communicated in a later paper.

G. S.

Behaviour of Sulphuric Acid in Ester Formation. Anton Kailan (*Monatsh.*, 1909, **30**, 1—27).—Measurements of the velocity of formation of ethyl hydrogen sulphate at 25° in dilute and in concentrated aqueous alcohol and with various concentrations of sulphuric acid show that the reaction is unimolecular. The esterification constants, calculated from the equation for unimolecular reactions, are expressed as a function of the water-content (w) and of the concentration of the sulphuric acid (c) by the following equation, the time being in hours: $1/k = 99{\cdot}80 + 7{\cdot}578/c - 1{\cdot}101/c^2 + (123{\cdot}7 - 85{\cdot}00/c + 14{\cdot}43/c^2)w + (106{\cdot}5 + 251{\cdot}8/c - 25{\cdot}47/c^2)w^2$. This equation holds for $w = 0{\cdot}05 - 1{\cdot}4$ and for $c = 0{\cdot}12 - 0{\cdot}6$; also for $w = 0{\cdot}1 - 0{\cdot}2$, it is correct up to $c = 1{\cdot}4$.

The addition of water causes less retardation in the formation of ethyl hydrogen sulphate than in the formation of ethyl chloride. The addition of alcoholic hydrogen chloride causes an increase in the velocity of formation of ethyl hydrogen sulphate varying from about 30% to 60% according to the concentrations of the hydrochloric and sulphuric acids; this increase is considerably less than would be expected if the catalysis were produced by the hydrogen ions.

The constant of esterification of β-phenylpropionic acid by alcoholic sulphuric acid at 25° varies with the concentrations of water ($w = 0{\cdot}06 - 1{\cdot}3$) and sulphuric acid ($c = 0{\cdot}16 - 0{\cdot}69$) according to the expression: $1/k = 0{\cdot}0824 + 0{\cdot}2515/c + 0{\cdot}01752/c^2 + (-1{\cdot}319 + 2{\cdot}246/c - 1{\cdot}336/c^2)w + (-0{\cdot}0480 - 0{\cdot}2062/c + 0{\cdot}1091/c^2)w^2$.

In alcohol containing little water, the increase of the esterification velocity effected by sulphuric acid is only about one-third of that produced by hydrochloric acid. In general, the influence of added water is less with sulphuric than with hydrochloric acid, as regards both decrease of the reaction velocity and also the deviation of the value of k from proportionality to the concentration of the catalyst. T. H. P.

Steric Hindrance. I. Theory of Esterification of Organic Carboxylic Acids. ARTHUR MICHAEL (*Ber.*, 1909, **42**, 310—317. Compare Rosanoff and Prager, this vol., ii, 32; Prager, ii, 33).—Victor Meyer found that, in the esterification of aromatic acids by means of alcohol and hydrogen chloride, the greater the mass of the substituent, especially in the ortho-position, the lower the esterification (Abstr., 1894, i, 463; 1895, i, 93; 1896, i, 547). A similar rule was found by Sudborough and Lloyd to hold for substituted acetic acids (Trans., 1898, **73**, 81; 1899, **75**, 467; compare also Gyr, this vol., ii, 33). Menschutkin (Abstr., 1882, 595), without the use of a catalyst, found that the replacement of hydrogen in acetic acid lowered the velocity of esterification, but Lichty (Abstr., 1895, ii, 157; 1896, ii, 557) found that the substitution of chlorine increased the velocity, a result in direct opposition to that obtained with a catalytic agent. Goldschmidt's view (Abstr., 1906, ii, 219) that the true agent in catalytic esterification is a complex ion composed of the hydrogen ion and alcohol is rejected, and the opinion is expressed that a Kekulé "double molecule" is first of all formed, composed of hydrogen chloride and carbinol, for which there is experimental evidence (Archibald and McIntosh, Trans., 1904, **85**, 919), rather than combination between organic acid and catalyst. Such a "double molecule," it is thought, would be richer in chemical energy, and would resemble the acid more than the alcohol in properties. This would unite with the carboxylic acid, which would then decompose directly into ester, water, and halogen acid. In the case of alcohol and organic acid, the ortho-acid first formed would decompose into ester and water. Menschutkin's results are explained by the positive methyl group diminishing the free chemical energy of the carbonyl radicle, where chlorine, being negative, would increase it. This increase in the negative character of the acid itself, although increasing the esterification of the acid by the direct method, would diminish the attraction of acid for the halogen acid-carbinol molecule, and therefore a decrease in the esterification would result. The following table is given for the two methods:

	Direct.	Catalytic.		Direct.	Catalytic.
Formic acid	100·0	1124·0	*n*-Butyric acid	53·9	50·0
Acetic ,,	71·9	104·0	*iso*Butyric acid	11·8	2·6
Chloroacetic acid	102·8	78·8	*n*-Valeric acid	—	53·5
Dichloroacetic acid	253·1	2·1	*n*-Hexoic ,,	53·6	54·6
Propionic acid	66·7	91·9	*n*-Octoic ,,	50·0	54·7

The numbers are relative, and those in the first column are not comparable with those in the second. The paper concludes with a discussion of the influence of substitution in the various positions, the relative great decrease from propionic to butyric acids being emphasised; also, the analogous results obtained with aromatic acids and the influence of fluorine are explained on the author's hypothesis (compare also Goldschmidt, this vol., ii, 129). W. R.

Steric Hindrance. II. Influence of Substituents in Aromatic Carboxylic Acids on their Esterification. ARTHUR MICHAEL and K. J. OECHSLIN (*Ber.*, 1909, **42**, 317—330. Compare preceding abstract).—The influence of substituents like chlorine, bromine and iodine, nitroxyl, methyl and hydroxyl on the esterification of benzoic acids by the direct method was carried out by heating solutions of these acids, strength 1/100 mol. in 7·5 c.c. methyl alcohol, at temperatures like 135° or 165° in a closed tube, and, after a suitable period, the tube was opened and the contents titrated with $N/10$ barium hydroxide solution. The following table indicates the character of the results obtained after seventeen hours' heating at 135°:

	%.	Affinity constant.
Benzoic acid	20·0	0·006
o-Nitrobenzoic acid	21·2	0·616
m-Nitrobenzoic ,,	57·4	0·034
p-Nitrobenzoic ,,	40·0	0·040
o-Toluic acid	12·2	0·012
m-Toluic ,,	20·0	0·005
p-Toluic ,,	21·0	0·005
o-Chlorobenzoic acid	25·6	0·132
p-Chlorobenzoic ,,	37·3	0·0093

The small effect of chlorine and nitroxyl in the ortho-position is very marked, especially as compared with the effect of the methyl group; the influence exerted by a *m*-nitro-group is extraordinary: 74% can be obtained as ester at 165° after twenty hours. These results are directly opposed to those obtained by the indirect method; thus, for instance, with a catalyst, *o*-nitrobenzoic acid is only slightly esterified, and with the meta- and para-acids the esterification velocity is only two-thirds of the value for benzoic acid. Without a catalyst, the ratio is acid : *o* : *m* : *p* = 1 : 1 : 3 : 2. Similar experiments were carried out with butyric, the two crotonic, and the four chlorocrotonic acids, and with ortho-disubstituted benzoic acids. From the results of these experiments, the following conclusions are drawn : (1) In the presence of a catalyst, the velocity of esterification is conditioned chiefly by the affinity between acid and catalyst, and the results only show the influence of the substituent on this attraction. (2) The influence of substituents on the velocity of esterification of the carboxyl group can only be ascertained by the direct method. These furnish no experimental results which support the idea that the space occupied or the mass of the substituent influence the phenomena. (3) It is the chemical nature of the substituents which is the determining factor. (4) Although the indirect method shows a similarity to exist between acetic, crotonic, and benzoic acids, with the direct method it is only in the case of the meta- and para-aromatic acids that this analogy holds ; with the ortho-compounds it is only partial. W. R.

Present Status of the Solvate Theory. Harry C. Jones (*Amer. Chem. J.*, 1909, 41, 19—57).—This communication is a summary of the work carried out and published during the past ten years by Jones and his co-workers (compare Abstr., 1899, ii, 587, 628; 1900, ii, 262, 526; 1902, ii, 489; 1903, ii, 55, 131, 634, 637; 1904, ii, 235, 386, 710, 711; 1905, ii, 445, 509, 687, 794; 1906, ii, 66, 327, 329, 737, 827; 1907, ii, 147, 211, 212, 438; 1908, ii, 19, 259, 260, 474, 1011). J. V. E.

Forms of Matter. P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 27—38. Compare this vol., ii, 132).—In this continuation of the previous paper it is shown that the formation of the hydrosol form of barium sulphate is induced by increasing the number of centres of crystallisation; this can be effected by increasing the viscosity of the liquid medium or by increasing the degree of association of the reacting components of the solution. In the author's experiments the viscosity was increased by the use of nearly saturated solutions of zinc chloride or manganous thiocyanate, the reacting components in the first case being cadmium sulphate and barium chloride, and in the second, barium thiocyanate and manganous sulphate. The degree of association is increased by replacing the solvent water by solvents of smaller dissociating power. The conditions which thus favour the formation of the hydrosol form of barium sulphate are applicable to all substances.

From the observed facts relating to precipitation phenomena, the author shows how the conditions necessary for the production of typical colloids in the form of fully developed crystals can be deduced. So-called typical colloids can be obtained in the crystalline form by allowing extremely dilute solutions of the reacting components to interact slowly; in the case of very slightly soluble substances, increase of the solubility by suitable means also favours the formation of crystalline particles. The actual methods which have been used in the numerous cases recorded in the literature depend on one or other of these artifices. The influence of the concentration of the reacting solutions on the structure of precipitated aluminium hydroxide has been examined. Solutions of ammonia and aluminium chloride more concentrated than *N*/500 give rise to "amorphous" forms. Solutions less concentrated than *N*/2500 yield microscopic, crystalline forms. The phenomena thus observed with aluminium hydroxide (a "colloid") and barium sulphate (a "crystalloid") are exactly parallel; the quantitative differences are simply due to the fact that aluminium hydroxide is very much less soluble in water than barium sulphate. H. M. D.

Hydrogels in the Mineral Kingdom. Felix Cornu (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 15—18).—The author gives a list of minerals which belong to the group of hydrogels. These gels are products of all normal weathering processes, whether these take place in silicate rocks or in the oxidation zones of ore deposits.

For every mineral hydrogel it is possible to find a corresponding crystalloid form; such corresponding forms are grouped in a table by the author. The mineral gels are characterised by certain general properties in respect of form, cleavage, optical behaviour, etc.

H. M. D.

Theory of Tanning. Andrea Ricevuto (*Gazzetta*, 1909, 39, i, 28—34).—When a current is passed through a colloidal gelatin solution, the gelatin particles move towards either the anode or the cathode according as the reaction of the liquid is alkaline or acid, whilst no transport takes place if the reaction is neutral.

The author has carried out similar experiments on tannin, sumach, and a number of other tanning materials, which, as would be expected, in presence of an acid or a base assume a charge opposite in sign to that of the gelatin, whilst in neutral solution no precipitation occurs on mixing solutions of gelatin and the tanning material. It is noteworthy that dialysis removes the acidity from some of the original tanning materials, but not from others.

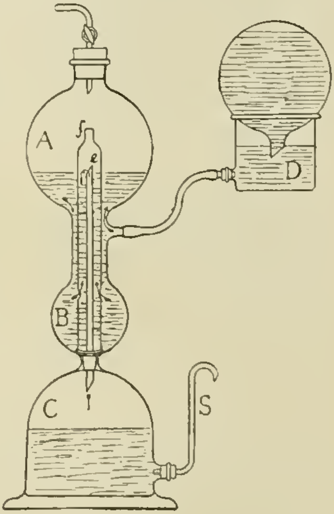
The author regards the determining cause of the phenomenon of tanning as the diversity of the electric charges carried by the colloidal particles, the action of the acid present being of the highest importance. T. H. P.

Atomic Weight Formula Based on the Law of Mass Action and Avogadro's Rule. August L. Bernoulli (*Zeitsch. physikal. Chem.*, 1909, 65, 391—427).—A more detailed account of work already published (Abstr., 1908, ii, 1001). The agreement between the international values of the atomic weights and the "kinetic" values calculated according to the author's theory is in some cases only moderate, but the agreement is better when, instead of the international values, "reduced" values calculated from the experimental data on the basis of some fundamental kinetic values are used. G. S.

Molecular Diameters. William Sutherland (*Phil. Mag.*, 1909, [vi], 17, 320—321).—The author points out that Jeans in his estimate of the diameters of various molecules (Abstr., 1905, ii, 14) neglected the effect of cohesional forces on viscosity, conductivity, diffusivity, and deviation from Boyle's law. A correction, $\sqrt{T/(T+C)}$, is therofore applied, where T is the absolute temperature and C is a parameter proportional to the mutual potential energy of two molecules in contact. A revised table of diameters of twelve gaseous molecules is given. R. J. C.

Molecular Dimensions on the Basis of the Kinetic Theory of Gases. Max Reinganum (*Ann. Physik*, 1909, [iv], **28**, 142—152).—A criticism of the values obtained by Sirk (*ibid.*, 1908, [iv], **25**, 894) for the dimensions of molecules. These numbers are deduced on the false assumptiom that the molecules are elastic spheres having no action on one another. When the attractive forces are taken into account, a different series of equations is obtained. In some cases the calculated results are in error, because of the fact that the coefficients of viscosity used in the calculations are about 50% too large.
H. M. D.

Continuous Apparatus for Preparation of Gases Evolved in the Cold. Maxime Gasnier (*Bull. Soc. chim.*, 1909, [iv], **5**, 56—58).—The apparatus shown possesses the advantage over Kipp's and others of the same class that the supply pressure remains constant whatever the amount of gas taken. Acid runs from constant level D into bulb A containing the solid reagent. The saline solution produced sinks by gravity into B, whence it eventually finds its way through tube e into the reservoir C, and is run off by syphon S. Insoluble sediment settles in B. If the rate of evolution of gas is not too fast, the liquid in C contains no free acid. The apparatus is more suitable to deliver a steady stream of gas during a long period than for an intermittent duty. It can be flushed out with water without opening. R. J. C.



Apparatus for Simultaneously Extracting a Solid and Filtering the Solution so Obtained. Frederick Record (*Chem. News*, 1909, **99**, 53. Compare Abstr., 1908, ii, 575).—The apparatus previously described, being made entirely of glass, required considerable skill for its construction. A slightly modified form, of simpler construction, has now been devised. The inner vessel, containing the filtering disk, is made separate from the outer vessel, being supported therein and held in position by a cork fitting into the mouth of the outer vessel. J. V. E.

Inorganic Chemistry.

Hypohalogenous Acids and Hypohalogenites. II. Kinetics of the Hypobromites in Weak Alkaline Solution. ANTON SKRABAL (*Monatsh.*, 1909, 30, 51—76. Compare Abstr., 1907, ii, 448).—The author has investigated the kinetics of the decomposition of a hypobromite into bromide and bromate in a solution containing hydroxyl ions in small, but constant, concentration. This constancy of concentration was effected by the use of sodium carbonate and sodium hydrogen carbonate in proportions sufficiently large compared with that of the hypobromite. With reference to the concentration of hypobromite, the decomposition of the latter is of the second order, the velocity of formation of bromate being proportional to the concentration of hydrogen ions. Diminution of the concentration of the hydroxyl ions is accompanied by increase of the velocity of the change, which is also accelerated by the presence of electrolytes, this accelerating action being especially marked in the case of the bromides. The following kinetic equation represents the decomposition: $-d[\mathrm{HBrO}]/dt=[\mathrm{H}^{\cdot}]\{[\mathrm{Br}']+e[E]\}K[\mathrm{HBrO}]^2$, $[E]$ being the concentration of the electrolyte and e and K constant factors. The action of an electrolyte is very approximately proportional to the number of ionic charges, but is independent of the nature of the electrolyte.

From the fact that, with small concentration of the electrolyte, the reaction proceeds according to the equation: $-d[\mathrm{HBrO}]/dt=[\mathrm{H}^{\cdot}][\mathrm{Br}']K[\mathrm{HBrO}]^2$, the conclusion is drawn that the mechanism of the reaction is similar to that of the hypoiodite reaction (*loc cit.*). Accordingly, in the hypobromite solution, an equilibrium, $\mathrm{HBrO}+\mathrm{Br}'+\mathrm{H}^{\cdot} \rightleftharpoons \mathrm{Br}_2+\mathrm{H}_2\mathrm{O}$ or $2\mathrm{HBrO}+\mathrm{Br}'+\mathrm{H}^{\cdot} \rightleftharpoons \mathrm{HBr}_3\mathrm{O}+\mathrm{H}_2\mathrm{O}$, must be rapidly set up, the reaction determining the velocity being the decomposition of Br_2 or $\mathrm{HBr}_3\mathrm{O}$ into bromide and bromate.

T. H. P.

The System Hydrogen Bromide and Bromine. ERNST H. BÜCHNER and B. J. KARSTEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 11, 504—508).—Sealed tubes containing weighed quantities of bromine and hydrogen bromide, dried by passing over phosphoric oxide, were placed in a mixture of alcohol and solid carbon dioxide or of calcium chloride and ice, and the temperature allowed to rise very slowly. The tubes were continually shaken, and the temperatures at which the last trace of solid disappeared were recorded. The end melting points, when plotted, indicate that there is an eutectic at about −95°, the composition corresponding with about 5 mols. % bromine. According to the curves no compound is formed. Although certain facts point to the formation of compounds between hydrogen bromide and bromine in solution, the authors point out that this is only true of ionising solvents, and that the union is probably determined by the bromine ion. In non-ionising solvents it is improbable that such union takes place.

H. M. D.

Revision of the Atomic Weights of Iodine and Silver. Gregory P. Baxter and George S. Tilley (*J. Amer. Chem. Soc.*, 1909, 31, 201—221; *Zeitsch. anorg. Chem.*, 1909, 61, 293—319).—With the object of obtaining a trustworthy value for the ratio of the atomic weight of silver to that of oxygen, careful analyses have been made of iodine pentoxide, the ratio of the atomic weights of silver and iodine being already known with great exactitude. A method is described for preparing pure iodic acid, and confirmation has been obtained of the existence of the compound I_2O_5,HIO_3 (compare Groschuff, Abstr., 1906, ii, 16). Iodic acid is almost completely converted into the pentoxide when heated at 240°, but a small quantity of water remains. The analysis of the iodine pentoxide was effected by dissolving the substance in water, reducing it to hydriodic acid with a suitable reducing agent, and titrating the hydriodic acid against a weighed amount of silver. It was found that hydrazine was the most satisfactory reducing agent, and that sulphur dioxide could not be used, as silver iodide occludes silver sulphate.

Iodine pentoxide has D_4^{25} 4·80. Experiments have been carried out which prove that this substance does not absorb appreciable quantities of air.

Two series of analyses have been made in which three different samples of iodine pentoxide and four samples of pure silver were employed. The ratio $2Ag:I_2O_5$ has been found to be 0·646230, whence the atomic weight of silver is 107·850, and that of iodine, 126·891 (O = 16). E. G.

Colour of Iodine Solutions. Joel H. Hildebrand and Ben Leon Glascock (*J. Amer. Chem. Soc.*, 1909, 31, 26—31).—Since Beckmann (Abstr., 1907, ii, 340) showed that the molecular weight of iodine in all solvents corresponds with the formula I_2, it has usually been accepted that the brown colour of certain solutions of iodine is connected with combination between the latter and the solvent. To test this view, the freezing-point depression produced by iodine and certain liquids, separately and then together, has been determined with bromoform and ethylene dibromide as solvents. Only for liquids which form brown solutions is the total depression less than the sum of the separate depressions, showing that combination has taken place.

The equilibrium between iodine and certain "active" solvents (those which can combine with iodine) has been investigated in such inactive solvents as carbon disulphide and carbon tetrachloride by a colorimetric method, and it is shown that for ethyl alcohol, acetic acid, ethyl acetate, and nitrobenzene the respective compounds contain 1 molecule each of the solvent and iodine. From the displacement of the equilibrium with temperature, it is calculated that the heat of combination of iodine and ethyl acetate is 3,600 cal. per mol. G. S.

Behaviour of Solutions of Hydriodic Acid in Light in the Presence of Oxygen. H. Jermain M. Creighton (*Trans. Nova Scotia Inst. Sci.*, 1908, 12, 49—60).—The object of the investigation is to account for the fact that the amount of iodine liberated from a solution of hydriodic acid or of acidified potassium iodide by oxygen and light reaches a maximum and then falls to zero.

The solution used contained one volume of aqueous potassium iodide (1 gram per litre) to eight volumes of dilute sulphuric acid (1 vol. of acid, D 1·84, to 5 vols. of water). The liberated iodine was titrated by *N*/1250 sodium thiosulphate.

A preliminary experiment showed that evaporation of the iodine is not wholly responsible for its disappearance, and also that the change of the iodine is accelerated by sunlight.

The acidified potassium iodide solution, 500 c.c., absorbed about 25 litres of oxygen in ten weeks, but neither iodine nor iodate could be detected in the solution, and strong reducing agents failed to liberate any iodine. The nature of the product is still a mystery.

C. S.

Polyiodides. F. Olivari (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 717—722).—The freezing-point curves have been determined for mixtures of metallic iodides with iodine, using an ordinary cryoscopic apparatus.

Mercuric iodide does not form a polyiodide; the curve has a eutectic point at 101·4° and 12·5 molecular % HgI_2. The curve for mixtures of calcium iodide and iodine has no distinct maximum, but an almost horizontal branch, having a eutectic point on the iodine side. The polyiodide, if formed, must be greatly dissociated at the melting point.

Tetramethylammonium iodide and iodine give a freezing-point curve presenting several maxima; some of the results are uncertain, owing to the hygroscopic nature of the substances. The polyiodide $NMe_4{\cdot}NI_9$ crystallises well in silky needles.

Phenyltrimethylammonium iodide forms four polyiodides, RI_4, RI_5, RI_7, and RI_9 ($R = NPhMe_3$), freezing at 112°, 83°, 63°, and 25° respectively. The results confirm the conclusion of Abegg and Hamburger (Abstr., 1906, ii, 747) that the stability of the polyiodides increases with the electro-positive character of the cation.

C. H. D.

Fluoro-salts. Fritz Ephraim and Paul Barteczko (*Zeitsch. anorg. Chem.*, 1909, 61, 258—264).—A tabular review of the known double fluorides is given. The Werner co-ordination number 6 is exceeded in a large number of cases. The number of hydrofluorometallic acids is also larger than with other halogen acids. The type $M'_5M''F_7$ is remarkable, a copper, cobalt, and nickel salt being known.

C. H. D.

Measurements of the Efficiency of Ozone Tubes. VII. Emil Warburg and G. Leithauser (*Ann. Physik*, 1909, [iv], 28, 1—16. Compare Abstr., 1906, ii, 740, 741).—The action of an ozone tube, regarded as a system of condensers in series with one another, is subjected to mathematical treatment. Some experiments are communicated which show the influence of the current strength and the frequency on the efficiency. With increasing current strength the efficiency falls, but rises with increase in the frequency until a certain limiting value is reached. Ozonisers with an inner metal tube are more efficient than those with an inner tube of glass. At a given discharge potential, small ozonisers combined with a high frequency of discharge yield as much ozone as larger ozonisers with a smaller frequency. H. M. D.

Production of Ozone from Oxygen and Atmospheric Air by means of Ozonisers. VIII. Emil Warburg and G. Leithäuser (*Ann. Physik*, 1909, [iv], 28, 17—36. Compare preceding abstract).—The dependence of the yield of ozone on the amount of ozone already present in the gas operated on has been examined. Equations are deduced for the case in which the ozoniser contains a motionless and homogeneous mixture, and also for that in which a steady flow of gas is maintained through the ozoniser. In the latter case, the percentage of ozone in the gas acted on by the discharge increases gradually from one end of the tube to the other. The yields of ozone determined experimentally are, in most cases, in agreement with the theoretical formulæ, but when oxygen is passed through the ozoniser the observed limiting ozone concentration is greater than that expected theoretically.

In the second part of the paper, the authors have investigated the variation of the yield of ozone with the current density and with the form of the induced current as modified by placing an induction-free resistance in parallel current; further, with the temperature and the nature and form of the ozoniser. Per kilowatt hour, the best yields are obtained when the diameter of the discharge chamber is large, but, on the other hand, if a high concentration is required, the two tubes of the ozoniser should be comparatively close together.
H. M. D.

Formation of Ozone at Stationary Linear Electrodes. Franz Fischer and Kurd Bendixsohn (*Zeitsch. anorg. Chem.*, 1909, 61, 153—180. Compare this vol., ii, 136).—A device is described by which the length of the anode, consisting of a strip of platinum foil, 0·01 mm. wide and sealed into glass, could be varied. Such electrodes are stable, but not those of only 0·005 mm. width.

A critical current density is observed, at which the potential difference shows a sudden increase, the current at the same time falling slightly. The current density at which this occurs is independent of the anode area, and falls with increasing concentration of acid. When it is exceeded, the yield of ozone diminishes greatly. On reducing the current after this point has been passed, the original potential is not observed, one several volts higher being always found. This behaviour of the anode is found to be due to incrustation of the anode, at a high current density, with platinum sulphate. Experiment shows that platinum sulphate, $Pt(SO_4)_2$, is insoluble in concentrated, but soluble in dilute, sulphuric acid.

A reduction in the width of a stationary anode increases the yield of ozone, as does a reduction of temperature, the yield increasing to 27% when the electrolyte is cooled to $-3·5°$. Since, however, the critical current density falls with decreasing temperature, a limit is set to the advantage to be derived from cooling. The critical point is also observed with rotating electrodes. C. H. D.

Dynamic Allotropy of Sulphur. II. [Binary] Systems containing Sulphur. Hugo R. Kruyt (*Zeitsch. physikal. Chem.*, 1909, 65, 486—510. Compare Abstr., 1908, ii, 1028).—In liquid sulphur there is equilibrium between the forms S_λ and S_μ. The theoretical part of the present paper contains a general discussion of the possible types of partial miscibility in liquid systems where a pseudo-binary substance, such as sulphur, forms one of the components, and no appreciable chemical reaction takes place.

A number of substances which react with sulphur between 100° and 200° are mentioned. Benzene, toluene, *m*-xylene, and triphenylmethane proved suitable for the investigation, as very little chemical reaction took place.

Benzene and sulphur are completely miscible above 160° and below 226°; the forms of the miscibility curves below and above these temperatures have been determined. Sulphur and toluene, and sulphur and triphenylmethane, show curves of similar type to the sulphur-benzene system; in the former system the limits of complete miscibility are 180° and 220°; in the latter case, 145° and 200°. The system sulphur—*m*-xylene gives a curve of entirely different type, as the components are not completely miscible in all proportions at any temperature within the limits employed. The types of curve observed are in accord with the theoretical deductions.

In several cases, notably in the system *m*-xylene–sulphur, retardation in the attainment of miscibility was observed, a result ascribed to the peculiarities in the behaviour of sulphur. G. S.

Statics of Liquid Sulphur in the Dark and under the Influence of Light. Albert Wigand (*Zeitsch. physikal. Chem.*, 1909, 65, 442—457. Compare Abstr., 1908, ii, 676).—The melting point of pure monoclinic sulphur is 118·95°.

The equilibrium $S_{8\text{ sol.}} \rightleftarrows S_{8\text{ insol.}}$ has already been determined by Schaum between 121° and 140°, and the author has now extended the observations from 117·1° to 119·6° by Schaum's method. The results fit in well with those of Schaum. From the results it is calculated that the heat of transition from the soluble to the insoluble form is −7180 cal. per gram-molecule, S_8, at 118·34°, as compared with −6000 cal. at 126·3°, −5390 cal. at 131·0°, and −4700 cal. at 135·9, calculated from Schaum's observations.

Some preliminary experiments indicate that the equilibrium is slightly displaced by light in favour of the insoluble form. As a source of light, arc lamps were used.

The possible constitution of the S_8 molecule is discussed. G. S.

An Automatic Hydrogen Sulphide Generator. Howard Waters Doughty (*J. Amer. Chem. Soc.*, 1909, 31, 60—62).—A modification of the apparatus devised by Bradley (Abstr., 1899, ii, 413).

The essential difference consists in an arrangement for drawing off the spent acid as fast as it settles to the bottom of the sulphide compartment. L. DE K.

Action of Sulphur Chloride, S_2Cl_2, on Metallic Oxides. FRANÇOIS BOURION (*Compt. rend.*, 1909, **148**, 170—171. Compare Abstr., 1907, ii, 690).—The joint action of chlorine and sulphur perchloride on some oxides is so violent that the oxide becomes incandescent, and a certain amount of oxychloride is formed instead of chloride. Ordinary sulphur chloride is now found to convert metallic oxides into chlorides even in those cases where the older method gave poor results.

The vapour of sulphur chloride is passed over the oxide contained in a tube heated just sufficiently to start the action, during which sulphur is liberated: $2MO + 2S_2Cl_2 = SO_2 + 2MCl_2 + 3S$. Most oxides are attacked slightly below or at the boiling point of sulphur, and the products are quite free from oxychloride. Samarium chloride prepared by this method contained 41·40% of chlorine, instead of the calculated 41·47%. R. J. C.

Hyposulphites. VI. ARTHUR BINZ (*Ber.*, 1909, **42**, 381—384. Compare Abstr., 1908, i, 940).—Purely theoretical. Reviewing recent work, the author decides that $O{:}SNa{\cdot}O{\cdot}SO_2Na$ best represents the constitution of sodium hyposulphite. C. S.

Electrochemical Reactions Induced by Sulphur Ions. MARIO G. LEVI and E. MIGLIORINI (*Gazzetta*, 1909, **39**, i, 110—120. Compare Levi and Voghera, Abstr., 1906, ii, 81, 348, 436).—As sodium thiosulphate may be formed electrolytically by the action of sulphur ions migrating and discharging themselves on sodium sulphite, the authors have made experiments to see whether other thio-salts and thio-organic acids are formed in this way.

With sodium arsenate, appreciable quantities of the thio-arsenate are formed, but with sodium antimonate and molybdate, no thio-salt is obtained; in all cases, most of the S''-ions undergo oxidation to SO_4''.

With formic and acetic acids, no thio-acid is formed, but hydrogen sulphide is always formed in the anode chamber containing the organic acid; the same phenomenon is observed when dilute sulphuric acid is used as anodic liquid. This hydrogen sulphide is formed electrochemically, and is not due to the direct action of the acid on the sulphide, since experiment shows that such action will not take place through the Puckall diaphragms employed in the time occupied by the electrolysis. The amount of hydrogen sulphide formed is proportional to the quantity of electricity passing if the current is low, but diminishes relatively when higher currents are used.

T. H. P.

Preparation of Hydrogen Selenide. HENRI WUYTS and AL. STEWART (*Bull. Soc. chim. Belg.*, 1909, **23**, 9—11).—Moissan and Étard obtained hydrogen selenide by heating selenium with colophene, an expensive hydrocarbon obtained by polymerisation of terebenthene. The authors find it advantageous to replace colophene with paraffin wax, which commences to boil at 380°. Paraffin wax is attacked by sulphur at 245°, but selenium requires a temperature of 335—340°.

A regular evolution of hydrogen selenide is obtained by heating selenium with four times its weight of paraffin in an air-bath. Organic selenium compounds which accompany the gas are mostly condensed at 60°. The hydrogen selenide may then be further purified by condensation by a mixture of solid carbon dioxide and acetone, and fractional distillation. The yield is 75 to 80% of the theoretical. R. J. C.

Electrolysis of Solutions of Selenious Acid. I. CAMILLO MANUELLI and GUIDO LAZZARINI (*Gazzetta*, 1909, **39**, i, 50—69).—When solutions of selenious acid are electrolysed, the acid undergoes simultaneous reduction to selenium and oxidation to selenic acid: $H_2SeO_3 + 2H_2 = 3H_2O + Se$ and $2H_2SeO_3 + 2O = 2H_2SeO_4$. Selenic acid may be conveniently prepared in this way, since the electrolysis gives rise neither to intermediate reduction products nor to complex acids, as is the case when sulphurous acid is electrolysed. The authors have studied the influence of the conditions of electrolysis on the yields of selenium and selenic acid; theoretically, 0·7388 gram of selenium should be separated at the cathode per ampere-hour, whilst at the anode a quantity of selenious acid corresponding with 1·4776 gram of selenium should be oxidised.

The results show that diminution of the concentration of selenious acid and increase of the concentration of selenic acid are accompanied by a fall in the current yield both of selenium and selenic acid. When a large anode and consequently a small anodic current density is employed, the yield of the oxidation product is large, whilst with a large cathode a high yield of selenium is obtained. The diminished yield of selenic acid obtained when the quantity of this acid increases is not due to the establishment of an equilibrium between the oxidation of the selenious acid and the reduction of the selenic acid, since in the electrolysis of the latter, only a small amount of reduction occurs. The yields at 54—58° are not markedly different from those at 25°.

T. H. P.

Atomic Weight of Tellurium. VICTOR LENHER (*J. Amer. Chem. Soc.*, 1909, **31**, 20—24).—The method depends on the fact that when potassium telluribromide, K_2TeBr_6, is heated strongly in a current of chlorine, and finally in hydrogen chloride, only potassium chloride remains behind; the latter is then weighed.

Tellurium ores from three different sources were employed. The oxide obtained from the ores was converted into the double bromide by the action of hydrobromic acid and potassium bromide; the double bromide was crystallised repeatedly from water containing a little dilute hydrobromic acid, and was finally kept over soda-lime in a vacuum for eight months.

As a mean of sixteen concordant experiments, the value Te = 127·55 was obtained (Cl = 35·46, Br = 79·92, K = 39·095), in exact agreement with the International value. The products from different sources gave identical results. G. S.

Non-existence of Tellurium Oxychloride. VICTOR LENHER (*J. Amer. Chem. Soc.*, 1909, **31**, 243—244).—Tellurium dioxide (1 mol.) unites at about 0° with hydrogen chloride (3 mols.), and, on raising the temperature, 1 mol. of hydrogen chloride is eliminated with formation of the compound $TeO_2,2HCl$. When this substance is heated at 280—300°, it is not converted into the oxychloride, $TeOCl_2$, as stated by Ditte (Abstr., 1877, i, 45), but into a mixture of the tetrachloride and dioxide without the intermediate formation of an oxychloride. If the tetrachloride and dioxide are heated together, combination does not take place, but, on cooling, the original compounds are recovered unchanged. E. G.

Reaction between Fused Potassium Nitrate and Tellurium Dioxide. VICTOR LENHER and P. D. POTTER (*J. Amer. Chem. Soc.*, 1909, **31**, 24—26).—When tellurium dioxide is fused with potassium nitrate, yellowish-brown substances are noticed swimming in the fused mass; on continued heating, the mass becomes clear, the conversion to potassium tellurate being then complete. The brown products have been isolated by extracting with water until nothing further dissolves, and on analysis prove to be compounds of potassium tellurate with tellurium dioxide in proportions depending on the time of heating and other conditions. The same brown compounds have been prepared by fusing together potassium tellurate and tellurium dioxide; they are insoluble in dilute acids and alkalis, but are slowly decomposed by hot strong hydrochloric acid with evolution of chlorine. Analogous compounds are obtained by fusing tellurium dioxide with sodium nitrate. G. S.

Atomic Weights of Nitrogen and Silver. THEODORE W. RICHARDS, PAUL KÖTHNER, and ERICH TIEDE (*J. Amer. Chem. Soc.*, 1909, **31**, 6—20; *Zeitsch. anorg. Chem.*, 1909, **61**, 320—337).—The method employed was the analysis of ammonium chloride by decomposing with silver nitrate and weighing the resulting silver chloride. The results of Scott (Trans., 1901, **70**, 147) are regarded as untrustworthy, because the solubility of silver chloride was not sufficiently allowed for; the earlier investigations of Stas are unsatisfactory for the same reason, and also because the ammonium salt was not free from organic impurities.

One specimen of the salt was prepared as follows: Organic impurities were removed by heating the ammonium sulphate with concentrated sulphuric acid and a little potassium permanganate until the solution became perfectly colourless (Kjeldahl). To a solution of the acid ammonium sulphate, pure calcium oxide was added, and the mixture placed in a desiccator, which also contained a platinum dish filled with hydrochloric acid. On exhausting, the ammonia was absorbed by the acid. Another sample was prepared by the electrolytic reduction of nitric acid, as described by Hinrichsen (Abstr., 1908, ii, 494).

The samples were recrystallised from dilute ammonia, and perfect neutrality and complete dryness were secured by subliming first in an atmosphere of ammonia and then in a Sprengel vacuum (to remove excess of ammonia), quartz vessels being used throughout. The methods employed are fully described.

The ratio $NH_4Cl : AgCl$ was determined by methods analogous to those fully described in previous papers, and nine very concordant results are quoted. From these and previous results of Richards and his co-workers, the following values are obtained: Ag = 107·881; Cl = 35·4574; N = 14·0085, based on O = 16·000 and H = 1·0076 (Morley). The results furnish striking evidence in favour of the low values for nitrogen and silver recently advocated from different quarters. G. S.

Products of the Arc and Spark Electric Discharge in Liquid Argon or Nitrogen. III. Tin Nitride and Pyrophoric Tin. Franz Fischer and George Iliovici (*Ber.*, 1909, **42**, 527—537. Compare Abstr., 1908, ii, 1034; this vol., ii, 139).—By using tin as electrode in argon, 86—114 mg. per hour of a substance was prepared which behaves abnormally, as compared with the other substances obtained (*loc. cit.*), towards cold concentrated nitric acid. It is slightly altered by exposure to air, and a special apparatus was constructed so that, not only the substance could be prepared, but it could also be heated in the absence of air. When heated to redness in a quartz tube, nitrogen was evolved (proved by spectrum and sparking with oxygen); the maximum amount obtained was 3·18%, but analysis of various specimens gave generally less nitrogen, and the substance is a mixture of metal, nitride, and some oxide.

Calcium as an electrode when placed in a gasometer removes the oxygen and nitrogen from argon. The calcium arc discharge acts best when the calcium sublimes on the walls of the vessel; by this means the argon is rendered very pure, the "substance" from the tin electrode discharge containing no oxygen and only 0·8% of nitrogen. In this case the tin was rendered pyrophoric, due to the fine state of division. W. R.

Chloroamine. Fritz Raschig (*Verh. Ges. deut. Naturforsch. Aertze.*, 1907, II, i, 120—123).—The well-known hypochlorite colour reaction of aniline is or is not obtained according as ammonia is added after or before the hypochlorite and the aniline solutions are mixed. Moreover, whilst concentrated solutions of ammonium hydroxide and sodium hypochlorite immediately evolve nitrogen when mixed, gas is evolved from dilute solutions only after some time. These facts led the author to deduce the existence of a compound intermediate between ammonia and nitrogen. Solutions containing equal molecular quantities of ammonia and sodium hydroxide react quantitatively, thus: $NaOCl + NH_3 = NH_2Cl + NaOH$; by distilling the solution in a vacuum at a low temperature, *chloroamine*, NH_2Cl, can be obtained as an unstable, faintly yellow oil floating in the distillate water. The solution of chloroamine, obtained as above, yields with potassium iodide at first a brown solution and then a black precipitate of nitrogen iodide, and with potassium cyanide, cyanogen chloride, and ammonia, oxidises sulphurous acid, and reacts with alkali hydroxides, the more rapidly the greater the concentration of the alkali, to form ammonia, nitrogen, and potassium chloride: $3NH_2Cl + 3KOH = NH_3 + N_2 + 3KCl + 3H_2O$. The reaction with ammonia is similar: (I) $3NH_2Cl + 2NH_3 = N_2 + 3NH_4Cl$, but in addition a small quantity of hydrazine is formed, (II) $NH_2Cl + NH_3 = N_2H_4,HCl$. After many trials the author has succeeded in hindering reaction I and accelerating reaction II to such an extent that by treating normal sodium hypochlorite solution with fifty times the calculated quantity of ammonium hydroxide in the presence of a little glue, 75—80% of the calculated quantity of the ammonia is converted into hydrazine. C. S.

Oxidation of Hydrazine. III. Arthur W. Browne and F. F. Shetterly (*J. Amer. Chem. Soc.*, 1909, 31, 221—237).—In earlier papers (Abstr., 1907, ii, 863; 1908, ii, 373) an account has been given of the oxidation of hydrazine sulphate by ammonium metavanadate, and potassium chlorate, bromate, and iodate. Experiments are now described on the behaviour of aqueous solutions of hydrazine sulphate towards potassium persulphate, permanganate, and perchlorate, hydrogen peroxide, sodium periodate, red lead, and lead and manganese dioxides, with the object of determining the amounts of azoimide and ammonia produced in each case under certain conditions.

When hydrazine sulphate was heated with potassium persulphate in presence of sulphuric acid, the maximum yield of azoimide was 40·3%, whilst that of ammonia was 1·5 mols. from 2 mols. of hydrazine. In alkaline solution, only small amounts of azoimide were produced and about 20% of ammonia. The methods described by Pannain (Abstr., 1904, ii, 638) and Rimini (Abstr., 1906, ii, 898) for estimating persulphates by means of hydrazine sulphate are inaccurate, on account of the formation of azoimide and ammonia.

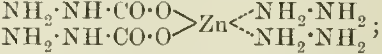
When hydrazine sulphate was treated in acid solution with potassium permanganate, maximum yields of 3·19% of azoimide and 1·65 mols. of ammonia from 2 mols. of hydrazine were obtained, whilst in alkaline solution only small quantities of azoimide were formed. Petersen (Abstr., 1893, ii, 605) has expressed the reaction between hydrazine sulphate and potassium permanganate in presence of sulphuric acid by the equation: $17N_2H_4,H_2SO_4 + 13O = 13H_2O + 7(NH_4)_2SO_4 + 10N_2 + 10H_2SO_4$. It is now proved that the greater part of the hydrazine is converted into nitrogen and ammonia, as Petersen has stated, but that, under certain conditions, appreciable quantities of azoimide are formed.

With hydrogen peroxide in acid solution, maximum yields of 38·5% of azoimide and 1·10 mols. of ammonia from 2 mols. of hydrazine were produced, whilst in alkaline solution only small amounts of azoimide, and fairly large amounts of ammonia, were formed.

The maximum yields produced by potassium perchlorate in acid solution were 22·4% of azoimide and 44% of ammonia. When hydrazine sulphate was treated with sodium periodate in acid solution in presence of silver sulphate to prevent the liberation of iodine, considerable quantities of azoimide were formed. With lead dioxide in acid solution, maximum yields of 4·1% of azoimide and 13·2%

of ammonia were obtained. Red lead and manganese dioxide also oxidise hydrazine sulphate to azoimide and ammonia, the maximum yields in the latter case being 2·32% of azoimide and 1·53 mols. of ammonia from 2 mols. of hydrazine. E. G.

Action of Zinc on Hydrazine Hydrate. Erich Ebler and E. Schott (*J. pr. Chem.*, 1909, [ii], **79**, 72—74. Compare Abstr., 1908, ii, 1029).—When zinc is partly immersed in hydrazine hydrate and exposed to the action of the air, a white, crystalline substance is formed with the evolution of hydrogen. Analyses show that this compound is *zinc hydrazinecarboxylate dihydrazinate*,



$$\begin{array}{l}NH_2\cdot NH\cdot CO\cdot O\\ NH_2\cdot NH\cdot CO\cdot O\end{array}\!>Zn<\!\begin{array}{l}NH_2\cdot NH_2\\ NH_2\cdot NH_2\end{array};$$

it does not give a precipitate with a solution of a chloride of an alkaline earth, but when the solution is boiled, the substance is hydrolysed and the carbonate of the alkaline earth precipitated.

W. H. G.

Action of Air and Oxidising Agents on Coals. Octave Boudouard (*Compt. rend.*, 1909, **148**, 284—286).—In contact with air at 100°, coal readily undergoes oxidation, the increase in weight through absorption of oxygen may amount to 10%. After oxidation in this way, coal is found to contain humic acid, and to have lost its property of coking. Concentrated nitric acid causes more complete oxidation and increases the yield of humic acid.

Analyses are given of anthracite, coal, and lignite before and after oxidation. W. O. W.

Weight of Carbon Dioxide with a Table of Calculated Results. Samuel W. Parr (*J. Amer. Chem. Soc.*, 1909, **31**, 237—243).—In view of the discrepancies between the various tables of the weights of 1 litre of carbon dioxide at different temperatures and pressures, a new series of values has been calculated. Dietrich (*Zeitsch. anal. Chem.*, 1864, **4**, 142) published a table in which he employed the value 1·9678 for the observed weight of 1 litre of carbon dioxide at 0° and 760 mm., which agrees fairly well with those usually employed at the present time (compare Guye, Abstr., 1907, ii, 605). On correcting this value for the latitude 41° and an elevation of 100 metres, it becomes 1·9760. The coefficient of expansion of carbon dioxide at constant volume has been given by Chappuis as 0·0037135. Employing these values, a new table has been compiled, the calculations being made by means of the formula

$$W = 1{\cdot}976(P - w - b)/760(1 + 0{\cdot}0037135 \times t),$$

where W is the weight of 1 litre observed volume reduced to 0° and 760 mm.; P, the observed pressure; w, the correction for tension of aqueous vapour; and b, correction for barometer, glass scale.

E. G.

Properties of Hydrogels when Dehydrated. Jakob M. van Bemmelen (*Chem. Weekblad*, 1909, **6**, 63—82; *Zeitsch. anorg. Chem.*, 1909, **62**, 1—23).—A continuation of the author's criticism (Abstr. 1908, ii, 838) of Tschermak's silicic acid formulæ (Abstr., 1905, ii. 816). A. J. W

Phenomenon Observed in the Action of Hydrochloric Acid on very Dilute Alkali Amalgams. G. McPhail Smith (*J. Amer. Chem. Soc.*, 1909, **31**, 31—35).—In the decomposition of the alkali amalgams by means of hydrochloric acid, a point is reached at which there is a sudden increase in the surface-tension of the amalgams, which is accompanied by the sudden evolution of a cloud of very small bubbles of hydrogen, and by a sudden fall in the potential between the amalgam and the solution. G. S.

Theory of Bell-chamber Process for Electrolysis of Alkali Chlorides. M. F. Chancel (*Bull. Soc. chim.*, 1909, [iv], **5**, 58—61). —The author controverts some of Brochet's conclusions (Abstr., 1908, ii, 1034). The concentration of the alkali obtained in this process should be proportional to the conductivity of the salt solution, but independent of the mobility of hydroxyl ions. In order to obtain a theoretical yield of sodium hydroxide on the current used, the velocity of the liquid away from the cathode must exceed a certain minimum. With a slower flow a more concentrated solution is obtained, but the yield on the current is less, owing to the alkali hydroxide taking part in the electrolysis. In practice convection currents interfere, and the theoretical conditions are never realised. R. J. C.

Colloidal Potassium Chloride. Carl Paal and Kurt Zahn (*Ber.*, 1909, **42**, 277—290. Compare Abstr., 1906, ii, 351, 749; 1908, ii, 179).—Organosols of potassium chloride, similar to those of sodium chloride, are obtained by the action of ethyl chloroacetate, chloroacetophenone, chloroacetone, and acetyl chloride on ethyl potassiomalonate and its ethyl, benzyl, and *i*-amyl derivatives. The liquid and suspended organosols are more stable than those of sodium chloride, and contain, as a rule, a higher percentage of the salt; thus solid potassium chloride organosols containing 93·6 and 96·4% KCl have been obtained. On drying, however, the organosols pass quickly into solid irreversible gels. The intermediate colloidal solution, which is seemingly a homogeneous liquid, gives, on filtration through paper, the liquid gel, the solvent being separated. This liquid gel is converted by light petroleum into a solid reversible gel, this being re-converted into the liquid form by benzene, which gradually passes on keeping into the irreversible form. Increase in the molecular weight of the malonate does not give any increase in stability of the colloidal potassium chloride. There are, therefore, five forms of these adsorption compounds of colloidal potassium chloride: a solid and liquid organosol, a liquid gel, and two solid gels, one of which is reversible. The importance of solvents free from water in this work is emphasised. W. R.

Colloidal Potassium Bromide and Iodide. Carl Paal and Kurt Zahn (*Ber.*, 1909, **42**, 291—300. Compare preceding abstract).—Adsorption compounds of colloidal potassium bromide are obtained by the action of ethyl bromoacetate, bromoacetophenone, bromoacetone, and acetyl bromide on ethyl potassiomalonate and its ethyl and benzyl derivatives in benzene, xylene, or ether solutions. The potassium bromide organosol cannot be obtained from the condensation of ethyl bromoacetate and ethyl potassiomalonate, the gel being formed, but it may be obtained from the potassium derivatives of ethyl ethyl- or benzyl-malonates. Liquid organosols and gels are given with benzene, whereas with ether the more stable solid organosol is obtained, which often may be preserved under ether for some days. On drying the organosols pass into irreversible gels. The liquid gels by transmitted light appear as cloudy liquids (compare sodium bromide, Abstr., 1908, ii, 179), due to separation of small quantities of irreversible gels, probably occasioned by traces of water. These substances are therefore less stable than the colloidal potassium chloride compounds.

By the action of ethyl β-iodopropionate on ethyl potassiobenzylmalonate in benzene or ether solution, there result a labile organosol as well as the irreversible gel of potassium iodide. W. R.

Double Salts of Ammonium Sulphate and Ammonium Nitrate. FRANS A. H. SCHREINEMAKERS and P. H. J. HOENEN (*Chem. Weekblad*, 1909, **6**, 51—56).—From aqueous solutions of ammonium sulphate and ammonium nitrate at 30°, the two double salts, $(NH_4)_2SO_4,(NH_4NO_3)_2$ and $(NH_4)_2SO_4,(NH_4NO_3)_3$, have been isolated. They are decomposed by water, but are stable in presence of excess of ammonium nitrate. A. J. W.

Effect of Water on the Freezing Point of Molten $CaCl_2,6H_2O$. J. LIVINGSTON R. MORGAN (*J. Amer. Chem. Soc.*, 1909, **31**, 251—252; *Zeitsch. anorg. Chem.*, 1909, **61**, 347—348).—An acknowledgment of the error in calculation pointed out by Cock (this vol., ii, 18) in Morgan and Benson's paper on molten hydrated salts as solvents for the freezing-point method (Abstr., 1907, ii, 747). E. G.

Rapid Preparation of Calcium Phosphide for the Evolution of Hydrogen Phosphide. CAMILLE MATIGNON and R. TRANNOY (*Compt. rend.*, 1909, **148**, 167—170).—Hydrogen phosphide, usually prepared by the action of dilute acid on aluminium phosphide, may also be prepared from calcium phosphide. Calcium phosphate, the source of all phosphorus compounds, is intimately mixed with the correct amount of aluminium powder and ignited. A mixture of calcium phosphide, aluminium oxide, and a trace of calcium results, which readily yields hydrogen phosphide with acidified water. The gas is not spontaneously inflammable, and its only impurity is a small proportion of hydrogen.

A small acetylene generator may be employed, or the powdered phosphide may be placed in a flask with water, and dilute hydrochloric acid run in from a dropping funnel. R. J. C.

Double Fluorides and Chlorides of Univalent Thallium. FRITZ EPHRAIM and PAUL BARTECZKO (*Zeitsch. anorg. Chem.*, 1909, **61**, 238—257).—Thallous fluoride is best prepared by dissolving thallium in dilute sulphuric acid, removing lead as sulphide, precipitating thallous sulphide from alkaline solution, and dissolving in hydrofluoric acid.

Ferric thallous fluoride, $3TlF,2FeF_3$, prepared by evaporating a solution of ferric and thallous fluorides, the former being in excess, separates in bright pink crystals.

Chromic thallous fluoride, $3TlF,2CrF_3$, prepared in similar manner, forms a green, crystalline powder. The *aluminium* compound, $3TlF,2AlF_3$, forms white crystals. All these salts are decomposed only slowly by sodium carbonate, especially the aluminium compound, indicating the presence of complex ions.

An aqueous solution of thallous and lead chlorides deposits only the original mixture of salts on evaporation. In hydrochloric acid solution, *thallous lead chloride*, $TlCl,PbCl_2$, is formed, and crystallises in six-sided, elongated leaflets.

Thallous chloride dissolves in molten antimony trichloride, and on the addition of concentrated hydrochloric acid, the *double* salt,

$$3TlCl,SbCl_3,$$

is precipitated in light yellow, lustrous scales. When antimony pentachloride is used in the same way, it rapidly loses chlorine, and a *double* salt of thallous chloride and antimony tetrachloride is obtained as a dark violet solid, $TlCl,SbCl_4$, the yellow *compound* first formed, which is probably $TlCl,SbCl_5$, being unstable, and blackening in the air. By passing chlorine into a solution of thallous chloride in antimony trichloride, a black, felted mass is obtained, containing quadrivalent antimony, and probably having the formula

$$TlCl_3,2TlCl,2SbCl_4,$$

part of the thallium being oxidised to the thallic state.

Thallous bismuth chloride, $3TlCl,BiCl_3$, prepared in hydrochloric acid solution, forms large, very thin, colourless plates, rapidly breaking up into opaque, white scales. When a less excess of bismuth chloride is employed, a second *compound*, $6TlCl,BiCl_3$, is obtained, resembling the first in appearance.

Thallium is best estimated as iodide, a slight excess of potassium iodide being added at 50—60°. After twelve hours, the precipitate is collected on a Gooch filter, using only very gentle suction, and washed with pure water. C. H. D.

Burning of Admixtures on Refining Copper in a Reverberatory Furnace. V. Vanjukoff (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1649—1675).—After discussing the literature of the purification of copper by the so-called Swansea or dry refining process, the author gives the results of his own investigations in this direction.

Before the copper is melted in the reverberatory furnace, its temperature apparently falls, whilst during boiling the temperature rises, the exothermic reaction: $2Cu_2O + Cu_2S = 6Cu + SO_2 + 39$ Cal. then taking place. The end attained by the second refining is the removal of arsenic and antimony; the fact that only a slight amount of arsenic is burnt away during the first refining is explained by the layer of slag and sulphur compounds covering the copper, this layer preventing oxidation. Up to the end of the oxidation period, sulphur exists in the copper in the forms of cuprous sulphide and sulphur dioxide. The course of the refining was followed by analysing the gases evolved. T. H. P.

Ancient Copper Objects from Transcaucasia. Wladimir A. Skinder (*Bull. Acad. Sci. St. Petersburg*, 1909, 1, 75—78).—The specimens investigated were covered with a greenish-red layer, which in one case reached a depth of 2 mm. Three specimens were analysed, with the following results: (1) Copper = 94·75%, iron = 0·37%, sulphur = 0·39%. (2) Copper = 96·80%, sulphur = 0·13%. (3) Copper = 97·01%, antimony = 0·05%, iron = 0·45%. The remainder in each case consisting of silicon, carbon dioxide, and oxygen in the adhering slag.

The superficial layer of the first specimen consists of malachite mixed with a small quantity of silica. Z. K.

Solid Solutions in the Dissociation of Cupric Oxide. Lothar Wöhler and W. Frey (*Zeitsch. Elektrochem.*, 1909, 15, 34—38. Compare Abstr., 1907, ii, 33).—Metallic copper is not formed in the dissociation of cupric oxide; cuprous oxide has, therefore, a lower dissociation pressure than cupric oxide. The first small quantities of cuprous oxide formed by the dissociation of cupric oxide diminished the pressure at which oxygen is in equilibrium with the mixture of oxides in a very marked way. If the oxide is not heated for very long, the same equilibrium pressure is attained, at a given temperature and for a given composition, whether oxygen has been removed from a higher oxide or caused to combine with a lower one. Very prolonged heating, however, somewhat diminishes the pressure. This is probably due, in part at least, to false equilibrium, resulting from the very slow rate of solution of cuprous and cupric oxide in each other.

T. E.

Phase Equilibrium of the Red Cupri-ferrous Sulphates. Arthur J. Allmand (*Zeitsch. anorg. Chem.*, 1909, 61, 202—237).—The red or yellow salts obtained by Étard (Abstr., 1879, 104) and by Scott (Trans., 1897, 71, 564) by the action of sulphuric acid on a concentrated mixed solution of cupric and ferrous sulphates correspond in composition with solid solutions of the general formula

$$(Cu,Fe)SO_4,H_2O.$$

This does not account for the colour, $FeSO_4,H_2O$ being white, and $CuSO_4,H_2O$, pale blue. The possibility that cuprous-ferric salts may also be present is not to be tested analytically, on account of the reactions taking place when the salts are dissolved in water.

In the study of the phase equilibrium, 60 c.c. of a 0·8 molar solution of cupric and ferrous sulphates were taken, and 75 c.c. of concentrated sulphuric acid added, in an atmosphere of carbon dioxide. The mixture was then shaken for three weeks in a thermostat at 25°, and the liquid and solid phases analysed separately, the solid being previously washed, first with sulphuric acid of the same concentration as the mother liquor, and then with alcohol.

The brown colour of the mixed salts increases in depth from both ends of the series, reaching a maximum in the crystals containing 18% Fe and 16% Cu. All the crystals are microscopically homogeneous. When heated gently in a test-tube, their reddish-brown colour becomes chocolate-brown, and finally mauve, the original colour being restored on exposure to air.

Only a very small quantity of ferric iron is present, and is to be regarded partly as an impurity, being formed by the reaction $Cu^{\cdot\cdot} + Fe^{\cdot\cdot} \longrightarrow Cu^{\cdot} + Fe^{\cdot\cdot\cdot}$. The quantity of SO_4 is always somewhat deficient, the salts being slightly basic in spite of the acidity of the solution. This basicity is probably due to hydrolysis of the ferric salt.

The curves expressing the relation of the liquid and solid phases present certain peculiarities, the origin of which is not fully explained. It appears that cupric sulphate dissolves in solid ferrous sulphate in the form of normal molecules up to about 75%. Beyond this limit, polymerisation occurs.

The red colour is not due to ferric salts or to cuprous oxide. A suggestion is made that the cause of the colour may be an oscillation of electrons, due to the presence of metals in different stages of oxidation, as in Baly's explanation of the colour of organic compounds, since ferric ferrocyanide and ferrous ferricyanide, in which similar conditions occur, are also coloured. C. H. D.

Preparation of Metallic Aluminium from Aluminium Silicate. Max Moldenhauer (*Metallurgie*, 1909, **6**, 14—19).—Aluminium silicate may be freed from silicon by reducing with carbon in the presence of ferric oxide, when iron silicide is formed. In practice, the dry clay, having the formula $Al_2O_3,2SiO_2$, is fused in an electric furnace with ferro-silicon (10% Si), the products being alumina, containing 13·4% SiO_2, and an iron silicide, containing 49% Si. The alumina is then fused in a separate furnace with hæmatite and carbon, the products being practically pure alumina and 10% ferro-silicon. The alumina is freed from mechanically admixed ferro-silicon by grinding and extracting with a magnet, and is electrolysed in solution in cryolite.

The freezing-point curve of mixtures of cryolite and alumina shows a rapid fall from the freezing point of cryolite (975°) to a eutectic point at 880° and 20% Al_2O_3. C. H. D.

The Apparent Retardation of Fusion of Aluminium. Camille Matignon (*Bull. Soc. chim.*, 1909, [iv], **5**, 91—92).—With reference to von Bolton's observation that aluminium wire may be heated above its melting point without losing its shape (*Zeitsch. Elektrochem.*, 1908, **14**, 766), the author points out that he has recorded this fact already (*Mon. Sci.*, 1900, [iv], **14**, 357), and explained it as due to the formation of a protective layer of alumina. T. A. H.

Sodium Alum. Warren R. Smith (*J. Amer. Chem. Soc.*, 1909, **31**, 245—247).—The existence of sodium alum (Augé, Abstr., 1890, 1059; Wadmore, Proc., 1905, **21**, 150) has been confirmed, and experiments are described which prove that it is a definite chemical compound It is a true alum, since it forms mixed and layer crystals with other alums. The following solubility data are recorded, which express the number of grams of the anhydrous salt, $Na_2SO_4,Al_2(SO_4)_3$, contained in 100 grams of a saturated solution.

At 10°, 26·9; at 15°, 27·9; at 20°, 29·0; at 25°, 30·1, and at 30°, 31·4. The quantities of the crystalline salt contained in 100 grams of the saturated solution are: at 10°, 50·8; at 15°, 52·7; at 20°, 54·8; at 25°, 56·9, and at 30°, 59·4. E. G.

The Constitution of Blast-Furnace Slags. M. THEUSNER (*Metallurgie*, 1908, 5, 657—667).—Finely-powdered slags containing 25—31% SiO_2, 14—18% Al_2O_3, and 43—51% CaO, were extracted with various solvents, the composition of the solution and of the residue being determined in each case by analysis. Citric acid, ammonium citrate, and ammonium chloride were used as solvents. The basicity of the slags depends on the ratio of lime to silica, and is practically independent of the proportion of alumina.

From the more basic slags, solvents at first extract lime, the ratio of alumina to silica in the residue remaining constant, whilst less basic slags are less attacked, and the residue contains more lime than the residue from the originally more basic specimens.

Acid slags are found, microscopically, to contain much melilite, which is absent from the basic slags. An artificial melilite behaves towards solvents in exactly the same manner as an acid slag. Artificial mixtures in different proportions show that the attack by solvents is greatest when the ratio of silica to alumina is highest.

Water attacks the slags much less readily than salt solutions. The lime is chiefly dissolved, small quantities of silica and alumina being also taken up in a colloidal form. C. H. D.

Magnetisable Manganese Alloys. X. Manganese-Aluminium-Copper. FRIEDRICH HEUSLER and FRANZ RICHARZ (*Zeitsch. anorg. Chem.*, 1909, 61, 265—279).—Forged alloys containing 20% or less manganese, and 6% or more aluminium, the remainder being copper, are entirely non-magnetic when quenched from a red heat in water or mercury, but after heating for several hours in boiling xylene, a maximum degree of magnetisability is reached, and the alloy is found to be free from hysteresis. The same alloys, slowly cooled, show hysteresis, which is the greater the slower the cooling through the critical range. The magnetic susceptibility decreases rapidly with increase in the proportion of aluminium.

The variation of magnetic properties with composition is expressed on a diagram with triangular co-ordinates. The conclusion is drawn that the maximum susceptibility is obtained when the alloys have the composition AlM_3, in which M represents manganese and copper, which replace one another isomorphously in the compound. In this isomorphous series, the magnetic susceptibility increases with increasing manganese, and a maximum should be reached by the compound $AlMn_3$, which is to be examined for its magnetic properties.

C. H. D.

The Production of Malleable Cast-Iron. FEDERICO GIOLITTI, F. CARNEVALI, and G. GHERARDI (*Atti R. Accad. Lincei*, 1908, [v], 17, ii, 748—754. Compare Wüst, Abstr., 1908, ii, 287).—The pearlitic zone observed by Wüst is also observed in mild steel (0·05%C) exposed to pure methane at 1100°, under which conditions carbon is freely deposited. The carbon varies in the first place regularly with the depth, increasing from the outside inwards, but, in cooling, segregation takes place, the ferrite crystals at the surface, and the cementite crystals lower down, growing at the expense of the intermediate zone. It is shown microscopically that the process of decarburisation depends much more on the action of gases than on the diffusion of solid carbon. C. H. D.

The Structure of Hardened Steel. W. J. KURBATOFF [and, in part, M. M. MATWEIEFF] (*Metallurgie*, 1908, **5**, 721—728).—Austenite is best prepared by quenching steel containing 1·8—2·2% of carbon from 1250° in mercury at 130°. No change is produced by heating such steel containing austenite at 65—85° for several months. At 118° recrystallisation is visible in a few days. At 180° austenite changes to troostite, this transformation reaching a maximum at 245°.

The reaction austenite $\rightleftarrows$ troostite proceeds from right to left at 110—150°, from left to right above 150°, and again from right to left above 1000°. Austenite is regarded as a lower carbide of iron, the composition of which approaches the formula Fe_7C. Troostite and sorbite appear to be solutions of carbon in β- and α-iron respectively. C. H. D.

Influence of Manganese on the System Iron–Carbon. FRIEDRICH WÜST (*Metallurgie*, 1909, **6**, 3—14).—Manganese readily vaporises and attacks the platinum of an electric furnace. A magnesite crucible is therefore placed inside a vertical iron tube, through which a current of nitrogen is passed. The iron tube is coated externally with asbestos and kaolin, and is surrounded by the heating tube of the resistance furnace.

The addition of manganese up to 13% lowers the freezing point of iron saturated with carbon. Further additions raise the freezing point, which is at 1250° in an alloy containing 80% of manganese. The temperature at which the eutectoid, pearlite, is formed is rapidly lowered by the addition of manganese, becoming 580° at 5% Mn, and disappearing at higher concentrations. The difference between the transition points on heating and on cooling is also increased.

Microscopically, the increase in the proportion of manganese is shown by the disappearance of graphite and the increase of cementite. The plates of cementite also increase in size, and the eutectic disappears, its place being taken by a solid solution of carbon in iron and manganese.

The iron-graphite eutectic point is displaced by manganese, being at 4·05% C for an alloy containing 50% Mn. Manganese thus enters into both series of solid solutions, that rich in iron and that rich in carbon. C. H. D

Metallic Hydroxides. HERMANN WALDEMAR FISCHER (*Habilitationsschrift, Breslau*, 1907).—The red colloidal hydroxide at first obtained by the hydrolysis of ferric chloride solutions is converted by the hydrochloric acid also formed into a yellow modification, insoluble in hydrochloric acid. Fresh suspensions of this modification show a green fluorescence. Neutralisation of a part of the acid hinders the formation of the yellow colloid. At 150—170° in a sealed tube, in concentrated solution, a violet-black, dense colloid is also formed, distinct layers of the yellow and black modifications being found together. The black colloid contains only 1·5—3% of water. Similar results are obtained with hydrolysable salts of other metals at 210°.

A study of the dehydration of the mineral ferric hydroxides leads to the conclusion that limonite and xanthosiderite are only colloidal goethite containing various quantities of adsorbed water. Xanthosiderite is thought to be identical with the yellow colloid described above. Goethite is a definite compound, whilst the existence of hydrohæmatite is doubtful.

When sodium hydroxide is added to a solution of chromic chloride, the precipitate formed soon re-dissolves, and a further addition of alkali is necessary to produce a precipitate. This process may be repeated several times. A method is also described of determining, by observations of the conductivity of such solutions, whether basic chlorides are formed. Barium hydroxide is used as the base, being added to solutions of metallic chlorides (0·1*N* chlorine) at 0°. The existence of the compounds $Fe_2Cl_5{\cdot}OH$ and $Fe_2Cl(OH)_5$ is clearly shown by the curves, as is that of $Al_2Cl(OH)_5$, $Cr_2Cl_5{\cdot}OH$, and $Cr_2Cl_4(OH)_2$.

C. H. D.

Resistance of Ferrous Solutions to Oxidation by the Air. T. WARYNSKI (*Ann. Chim. anal.*, 1909, **14**, 45—47).—Experiments showing that solutions of ferrous sulphate in presence of free sulphuric acid are very stable in contact with the air. Addition of strong hydrochloric acid renders them more liable to oxidation. Traces of certain substances, such as cupric chloride, platinic chloride, and palladium nitrate, greatly favour the oxidation process. L. DE K.

Absorption of Hydrogen by Metallic Nickel. ADOLF SIEVERTS and JOH. HAGENACKER (*Ber.*, 1909, **49**, 338—347).—The authors are unable to account for the discrepancy between Sieverts' work (Abstr., 1907, ii, 741) and Mayer and Altmayer's (Abstr., 1908, ii, 950) as to the amount of hydrogen absorbed by nickel at 360° and 560°. They have repeated and confirmed Sieverts' experiments, using about 3 grams, 16·5 grams, and 27 grams of nickel; Mayer and Altmayer's contention that equilibrium was not attained in Sieverts' experiments, owing to the large quantity of nickel used, is thus disproved.

Henry's law does not hold for hydrogen and nickel at 822° and 923°, the amount of hydrogen absorbed being more nearly proportional to the square root of the pressure. C. S.

Alloys of Cobalt and Bismuth. F. DUCELLIEZ (*Bull. Soc. chim.*, 1909, [iv], **5**, 61—62).—The author has attempted to obtain alloys of cobalt and bismuth by heating mixtures of the powdered elements to various temperatures in an atmosphere of hydrogen. No development of heat is observed, and malleable products are obtained in which the cobalt retains its magnetic properties and from which the bismuth can be distilled. R. J. C.

Solubility of Chromic Oxide. MILORAD Z. JOVITSCHITSCH (*Monatsh.*, 1909, **30**, 47—50).—The author finds that the statement that strongly ignited chromic oxide is insoluble in acids is incorrect. In two experiments, 2·85 grams and 0·815 gram of chromic oxide, after ignition first by means of a Bunsen flame, and subsequently for ten to fifteen minutes by a blowpipe flame, dissolved in concentrated nitric acid to the extents of 2·585 grams and 0·772 gram respectively; the residue in each case proved highly resistant to the action of the acid and only dissolved in traces.

Evaporation of the acid solution until nearly all odour of nitric acid has disappeared yields a dark brown mass, the absolute alcoholic solution of which gives on evaporation a green, crystalline crust recrystallisable from hot water. On analysis, this crust is found to be a *neutral chromic nitrate*, $Cr_2(ONO_2)_3$, which is stable towards light and takes up moisture (maximum, $3H_2O$) from the air, becoming a darker green. T. H. P.

Thorium. H. KARSTENS (*Zeitsch. Elektrochem.*, 1909, **15**, 33—34).—In reply to Meyer's criticism (this vol., ii, 53) the author gives further details of the chemical part of the work described by Boltou (this vol., ii, 53). The thorium chloride used was a pure white, crystalline substance, which dissolves completely in water and contains thorium and chlorine in the ratio required by the formula $ThCl_4$. If the temperature is allowed to rise too high, a yellow, non-crystalline product is obtained which contains oxygen. When the metal is shaken with 5% hydrochloric acid, 85% of it dissolves, but only 10% is present in the solution in the form of the complex acid. Comparison of the acid with meta-thorium chloride showed their properties to be different. T. E.

The Newly Discovered Element of the Tin Group. ANTON SKRABAL and PAUL ARTMANN (*Chem. Zeit.*, 1909, **33**, 143).—The metal of the tin group, obtained by Evans (Trans., 1908, **93**, 660) from thorianite, and by Ogawa (Abstr., 1908, ii, 953), from molybdenite, closely resembles molybdenum in its reactions. A metal resembling molybdenum, but differing from it in some reactions, was observed in certain specimens of iron and steel in 1897 (Boucher, Abstr., 1898, ii, 73; Ruddock, *Chem. News*, 1897, **76**, 118; Jones, *ibid.*, 171).

The authors have obtained from a ferro-vanadium a small quantity of a sulphide resembling that of molybdenum in its reactions, but failing to give the characteristic blue coloration when dissolved in nitric acid and evaporated with sulphuric acid. This metal may be identical with the new metal from thorianite. C. H. D.

Tetragenic Double Salts of Antimony Fluoride and their Applicability as Mordants. ARTHUR ROSENHEIM and HERBERT GRÜNBAUM (*Zeitsch. anorg. Chem.*, 1909, **61**, 187—201).—Tetragenic double salts are those containing four different elements or radicles, exclusive of water of crystallisation (Meyerhoffer, Abstr., 1903, ii, 292). Salts containing antimony fluoride as a component find application as mordants.

Antimony trifluoride, prepared from antimony trioxide and hydrofluoric acid, is best stored in vessels of white celluloid. Three hundred and eighty-five grams dissolve in 100 grams of water at 0°, and 564 grams in 100 at 30°. There is no appreciable hydrolysis below 30°. The solubility is increased by the addition of alkali salts, but very unequally, potassium sulphate having only a small effect, whilst potassium chloride, oxalate or tartrate increases the solubility greatly. When the quantity of alkali salt exceeds a certain limit, the tetragenic double salt separates.

More dilute solutions have been investigated by means of their conductivity. The conductivity of the mixed solution is compared with the sum of the conductivities of antimony fluoride and of the alkali salt at 0°. The solutions containing potassium nitrate, sulphate, and hydrogen oxalate do not give any evidence of the presence of complex ions, whilst solutions containing normal potassium oxalate and tartrate, ammonium oxalate, and potassium antimony tartrate indicate considerable formation of complex ions, even in dilute solution. The two classes of salts are very sharply distinguished by plotting curves, of which the ordinates are $\lambda_0(SbF_3 + X) - \lambda_0 SbF_3$, and the abscissæ, $\sqrt{v}$. Only those salts the complex ions of which persist in dilute solutions are of use as mordants.

Several of the double salts have been isolated in the crystalline solid state. Potassium nitrate forms the *salt*, $3KNO_3,SbF_3$; ammonium oxalate forms large, transparent crystals of $4(NH_4)_2C_2O_4,3SbF_3$; sodium oxalate forms $2Na_2C_2O_4,3SbF_3$, crystallising unchanged from water; potassium antimony oxalate forms the stable *salt*,

$$K_3SbO(C_2O_4)_2,SbF_3,8H_2O.$$

Mercuric chloride and cyanide, like antimony fluoride, have the power of forming tetragenic double salts, and all of these are very weak electrolytes, having also the power of forming complex ions.

C. H. D.

Some New Fluorides. Otto Ruff, Julian Zedner, Emil Schiller, and Alfred Heinzelmann (*Ber.*, 1909, 42, 492—497).—*Columbium pentafluoride*, CbF_5, was prepared by the action of fluorine on columbium containing about 3% of aluminium. The roughly-powdered metal contained in a boat was placed in a platinum tube 25 cm. long and 1·2 cm. diameter, the middle portion of which is inserted in an asbestos box; the constricted end of the tube is cooled by a lead worm, and connected to a receiver, from which moisture is carefully excluded. The fluorine when passed over the merely warmed columbium at once combined, and the reaction was finished when the tube began to cool. The box was next heated at 250°, when the pentafluoride distilled into the cooled portion of the tube, the aluminium fluoride remaining behind. On re-distillation in a vacuum at 110°, it is obtained as colourless, strongly refractive, monoclinic prisms, m. p. 72—73° (corr.) and b. p. 236°/760 mm. (corr.). It is very hygroscopic and dissolves in water, from which sodium hydroxide and ammonia precipitate columbic acid; yield 75%.

Tantalum pentafluoride, TaF_5, prepared in a similar manner, and purified by distillation in a vacuum at 90—100°, forms colourless, strongly refractive prisms, m. p. 94° (corr.) and b. p. 225—226·5°/760 mm. (corr.). It it very hygroscopic, dissolving in water, from which alkali and ammonia precipitate tantalic acid containing fluorine. It attacks glass slowly at ordinary temperatures, quickly at higher; yield 80—85%.

The reaction between uranium and fluorine is a very vigorous one, and the product chiefly consists of tetrafluoride mixed with some oxygenated substance and the hexafluoride in small quantities. *Uranium hexafluoride*, UF_6, is best prepared from the pentachloride cooled in an alcohol-carbon dioxide mixture. After the reaction is over, carbon dioxide is passed through the apparatus, the tube evacuated, and the product distilled. It forms glistening, colourless, fuming, monoclinic prisms, which do not melt, but sublime at the ordinary temperature under diminished pressure. It is very hygroscopic, is soluble in water, and attacks glass in presence of a trace of water, forming silicon tetrafluoride and uranium oxyfluoride. Its aqueous solution does not decolorise potassium permanganate, and ammonia forms ammonium uranate and fluoride. W. R.

Alloys of Platinum and Antimony. K. Friedrich and A. Leroux (*Metallurgie*, 1909, 6, 1—3).—The freezing point of antimony is not appreciably lowered by the addition of platinum. The freezing-point curve rises to a maximum at 1226° and 44·7% Pt, corresponding with the compound $PtSb_2$. A second compound, probably PtSb, is formed at 1045°. The curve then falls to a eutectic point at 685° and 77% Pt, and rises to the freezing point of platinum. Two reactions take place in the solid state, the compound PtSb being transformed into one richer in antimony, and a third compound, Pt_5Sb_2, being formed from alloys rich in platinum at 644°, the eutectic structure disappearing when the alloys are maintained for some hours at this temperature. The compound $PtSb_2$ readily blackens when heated. C. H. D.

The Platinum Compound Analogous to Purple of Cassius. Lothar Wöhler (*Verh. deut. Naturforsch. Aerzte.*, 1907, ii, 105—106). —The blood-red colour produced by stannous chloride in solutions of platinum salts darkens after a time, more rapidly on warming, and finally the solution becomes black and slightly turbid. The red colour is extracted by shaking with ether or ethyl acetate, and on addition of water a chocolate-brown precipitate forms, consisting of platinum, tin, and oxygen in varying proportions. When freshly precipitated, the substance is soluble in dilute hydrochloric acid, but becomes almost insoluble on drying. It does not diffuse through parchment paper, and is therefore regarded as an adsorption compound of colloidal platinum and colloidal stannic acid. The adsorbed metal does not show the ordinary reactions of colloidal platinum. A similar red solution is obtained by reducing platinic chloride with an ethereal solution of phosphorus in the presence of gelatin.

When stannous bromide and platinum tetrabromide are brought together, there is a reversible equilibrium: $2SnBr_2 + PtBr_4 \rightleftarrows Pt + 2SnBr_4$, which is displaced towards the left by raising the temperature. G. S.

Mineralogical Chemistry.

Optical Investigation of Sakhalin Naphtha. Michael A. Rakusin (*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 1735—1746. Compare Abstr., 1907, ii, 882, 883).—The author has carried out an optical investigation of the various fractions of Sakhalin naphtha, from the results of which conclusions are drawn as to the geological age of the naphtha. This age is divided into two periods: (1) that during which filtration and distillation occurred, and (2) that of carbonisation. T. H. P.

New Chromium Mineral from Servia. Milorad Z. Jovitschitsch (*Monatsh.*, 1909, **30**, 39—46).—The brooks below one of the branches of the Kopaonik mountains contain a small-grained, glittering sand, from which a magnet removes a dark dull portion, leaving light, shining crystals behind. After purifying from sandy impurities, these two constituents were examined separately.

The shining crystals, D 3·1, to which the author gives the name *chromitite*, give analytical numbers, which, if small proportions of aluminium and magnesium are neglected, correspond with the formula $FeCrO_3$, $Fe_2Cr_2O_6$, or Fe_2O_3,Cr_2O_3.

The dull crystals resemble magnetite, both in their appearance and in their magnetic properties, but on separating by means of a magnet placed at varying distances from the sand, three fractions were obtained containing (1) 66·99% Fe and 6·01% Cr; (2) 43—45% Fe and 21·5—25% Cr; (3) 34—38% Fe and 34—36% Cr. Fraction (2) corresponds with a compound having the formula $2Fe_2O_3,Cr_2O_3$, which the author regards as a transition stage to the chromitite crystals. T. H. P.

Rosasite, a New Mineral from the Mines of Rosas (Sulcis, Sardinia). Domenico Lovisato (*Atti R. Accad. Lincei*, 1908, [v], **17**, ii, 723—728).—The new mineral occurs sparingly in small veins, associated with malachite and aurichalcite, as compact, apparently fibrous, light green, mammellated masses, D^{20} 4·074, H 4·5.

CO_2.	CuO.	ZnO.	PbO.	H_2O.	Total.
30·44	36·34	33·57	trace	0·21	100·56

The analysis corresponds approximately with the formula

$$2CuO,3CuCO_3,5ZnCO_3.$$

It does not appear to be merely an intimate mixture of malachite and smithsonite.

A dark green mineral was found coating the rosasite, but in quantity insufficient for analysis. C. H. D.

Brugnatellite, a New Mineral Species Found in Val Malenco. Ettore Artini (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 3—6).—The asbestos strata of Val Malenco contain a mineral which has not been previously described, and which occurs in the form of flesh-red laminæ or laminar aggregates resembling mica and exhibiting ready cleavage and slight nacreous lustre. This mineral, to which the author gives the name *Brugnatellite*, is a hydrated, ultra-basic carbonate having the composition :

Insol. in HCl.	H_2O.	CO_2.	Fe_2O_3.	MnO.	MgO.	Total.
1·03	33·77	7·78	13·20	1·80	42·79	100·37

Replacing the small proportion of MnO by an equivalent amount of MgO, the above numbers are in good agreement with those required by the formula $Mg_6FeCO_{20}H_{21}$ or $MgCO_3,5Mg(OH)_2,Fe(OH)_3,4H_2O$. In its natural position, Brugnatellite is accompanied by asbestos, aragonite, magnesite, artinite, and brucite. T. H. P.

Composition of Warwickite. W. M. Bradley (*Amer. J. Sci.*, 1909, [iv], 27, 179—184).—Under I is given the mean of two analyses of material, D 3·342, separated by means of heavy liquids from a metamorphic limestone occurring in contact with granite at Amity, New York. The mineral has the form of minute, slender crystals, showing the characteristic copper-red reflections on the cleavage surfaces.

	B_2O_3.	TiO_2.	SiO_2.	MgO.	FeO.	Fe_2O_3.	Al_2O_3.	Total.
I.	21·29	24·86	1·39	35·71	9·15	4·76	2·91	100·07
II.	23·87	27·87	1·56	38·63	8·07	—	—	100·00

Spinel and magnetite are intimately associated and intergrown with the mineral, and deducting alumina and ferric oxide, together with equivalent amounts of magnesia and ferrous oxide, the composition of the pure mineral is recalculated under II. This corresponds with the formula $B_2O_3,TiO_2,3(Mg,Fe)O$ or $(Mg,Fe)_3TiB_2O_8$. L. J. S.

Diopside and its Relations to Calcium and Magnesium Metasilicates. Eugene T. Allen and W. P. White, with optical study by Fred. Eugene Wright and Esper S. Larsen (*Amer. J. Sci.*, 1909, [iv], 27, 1—47).—The thermal and optical relations of calcium metasilicate and of magnesium metasilicate have been previously studied (Abstr., 1906, ii, 683, 865), and the investigation is now extended to mixtures of these. Only one stable compound,

$$CaMg(SiO_3)_2,$$

was obtained, this being identical with diopside; it melts at 1380°, and has D 3·275; well-formed crystals were crystallised from molten calcium chloride. Two eutectics with melting points of 1348° and 1375° occur; the former consists of 60% diopside and 40% pseudo-wollastonite, and the latter of 95·5% of mixed crystals (these containing 62·5% diopside and 37·5% $MgSiO_3$) and 4·5% α-$MgSiO_3$. A method for the more accurate determination of the composition of eutectic mixtures is described. Six different series of solid solutions are recognised, only two of which contain more than 3 or 4% of the minor component; wollastonite may take up 17% of diopside, and diopside dissolves 60% of magnesium silicate. The specific-volume curve consists of three well-defined branches, the first corresponding with mechanical mixtures of pseudo-wollastonite and diopside, the second with solid solutions of α-$MgSiO_3$ in diopside, and the third with mixtures of the saturated mixed crystals and free β-$MgSiO_3$. There is a sharp minimum in the curve corresponding with diopside. A new method is described for determining the inversion temperatures of magnesium silicate and of the mixed crystals. L. J. S.

Glaucophane-rocks from Switzerland. Ulrich Grubenmann (*Zeitsch. Kryst. Min.*, 1909, 46, 128; from *Festschr. H. Rosenbusch, Stuttgart*, 1906).—Analysis of glaucophane from Lavintzie in the Bagne valley, Wallis, gave:

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O (at 100°).	Loss on ignition.	Total.	Sp. gr.
52·76	0·94	6·80	10·38	8·45	2·25	9·38	1·11	7·20	0·08	0·44	99·79	3·155

corresponding with $64Na_2Al_2Si_4O_{12} + 64Na_2Fe_2Si_4O_{12} + 40Ca(Mg,Fe)_3Si_4O_{12} + 51(Mg,Fe)_4Si_4O_{12}$.
The material differs from other glaucophanes in the high percentage of iron, and approaches crossite in composition. L. J. S.

Mineralogy of Sardinia. Andesine [Plagioclase] from Monte Palmas (between Sassari and Alghero). Federico Millosevich (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 22—24).—The author gives measurements of andesine found at Monte Palmas, the numbers being in good agreement with von Rath's values corrected by Dana. The crystals found have D 2·679, and are in nearly all cases twinned, various types of twinning being observed. Analysis gives the following numbers:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Na_2O.	K_2O.	Total.
59·14	25·74	0·32	7·87	6·87	0·61	100·55

The crystallographic and optical characters are in accord with the acid character indicated by the analytical numbers. T. H. P.

Meteorite of St. Christophe-la-Chartreuse (Vendée). Alfred Lacroix (*Chem. Zentr.*, 1909, i, 316; from *Bull. Soc. Sci. nat. de l'Ouest, France*, 1906, [ii], 6, 81—112).—The stone weighing 5396 grams which fell on November 5, 1841, at St. Christophe-la-Chartreuse, near Rocheservière, is a grey chrondrite with the following mineralogical composition: nickel-iron, 9·57; schreibersite and graphite, traces; troilite, 6·9; chromite, 0·67; olivine (near hyalosiderite), 42·83; hypersthene, 28·39; diopside, 3·46; felspar, 8·39. There is also present in small amount a monoclinic pyroxene similar to rhombic pyroxene in composition, which is referred to as *clinohypersthene*; this has crystallised out from the fused rhombic pyroxene, and it is identical with the artificially prepared magnesia-pyroxene; its presence has been detected in several chrondritic meteorites. Maskelynite and an undetermined mineral resembling monticellite are also present. The felspar has the composition $(Ab,Or)_{10}An_{11}$. The nickel-iron contains: Fe, 81·1; Ni, 17·8; Co, 1·1; P, trace. L. J. S.

Physiological Chemistry.

Influence of Oxygen on Athletes. Leonard E. Hill and Martin Flack (*Proc. physiol. Soc.*, 1909, xxviii—xxxvi; *J. Physiol.*, **38**).—Experiments on athletes designed to show the beneficial effect of oxygen inhalation. W. D. H.

Oxygen Capacity. Arthur E. Boycott and C. G. Douglas (*J. Path. Bact.*, 1909, **13**, 256—295).—The carbon monoxide method for determining the total oxygen capacity and volume of the blood gives satisfactory results in rabbits. Normal rabbits have about 5·5 c.c. of blood and 0·7 c.c. of oxygen capacity per 100 grams of body-weight; females have more dilute blood than males. About 93% of the total hæmoglobin in rabbits is in the blood. Experiments are given in detail showing the rate of regeneration of the blood after single and multiple hæmorrhages. Apparent anæmia after hæmorrhage and in aniline poisoning may be due to increase in the blood-volume. W. D. H.

The Sugar of the Blood. V. Peter Rona and Leonor Michaelis (*Biochem. Zeitsch.*, 1909, **16**, 60—67. Compare Abstr., 1908, ii, 117).—By the use of the methods previously described, it is shown that a considerable fraction of the blood-sugar is contained in the corpuscles. W. D. H.

Activation of Hæmolysin by Amino-acids. Takaoti Sasaki (*Biochem. Zeitsch.*, 1909, **16**, 71—80).—Guinea-pig's serum has very little hæmolytic action on the corpuscles of the goat and horse; the addition of glycine or alanine leads to active hæmolysis. W. D. H.

The Gastric Digestion of Caseinogen. Louis Gaucher (*Compt. rend.*, 1909, **148**, 53—56).—The digestion of milk was studied in the case of a dog with a duodenal fistula. Three phases could be distinguished: (I) In the first quarter of an hour after ingestion, the milk could be obtained from the fistula in a practically unchanged state. (II) It was afterwards obtained in a clotted form. (III) In the third phase it was more altered, and coloured with bile. The caseinogen passes the stomach without peptonisation, and clotting is not necessary for the subsequent stages of digestion. S. B. S.

The Part Played by Elementary Hydrogen in Metabolism. Carl Oppenheimer (*Biochem. Zeitsch.*, 1909, 16, 45—59).—Elementary hydrogen, like elementary nitrogen, plays no part in metabolism in the animal body. W. D. H.

Protein Metabolism in Development. John A. Murlin (*Proc. Amer. physiol. Soc.*, 1908, xxxi—xxxiii; *Amer. J. Physiol.*, 23).—In pregnant dogs there is a minus nitrogen balance in the first four weeks, and an increasing plus balance in the last five weeks of gestation. On a creatine-free diet, the creatinine output was constant, but during uterine involution after parturition, creatine appeared in the urine. The differences obtained by subtracting the total resting metabolism of the mother dog from the total metabolism of the mother and puppies after parturition are not quite proportional to the weights, probably because the metabolism in the puppies was reduced as they helped to keep each other warm. In the puppies, immediately after birth, the respiratory quotient was unity; this indicates combustion of carbohydrate (glycogen). W. D. H.

Fate of the Non-hydroxylated Benzene Ring of Protein in the Animal Body. Haralamb Vasiliu (*Bied. Zentr.*, 1909, 38, 46—48; from *Mitt. landw. Inst. K. Univ. Breslau*, 1908, 4, 355—374).—The benzoic acid obtained by oxidising foods with permanganate is derived from the α-phenylaminopropionic acid group of the protein; the benzene ring of the tyrosine group is destroyed.

The benzene ring of α-phenylaminopropionic acid is only to a very slight extent destroyed by herbivorous animals; most of it appears in the urine partly as hippuric acid and partly as α-phenylaminopropionic acid. In the human body, and most probably in the case of carnivorous animals, the greater part is destroyed, and only small amounts of α-phenylaminopropionic acid pass into the urine.

Experiments with sheep showed that 42% of the non-hydroxylated benzene was present in the urine as hippuric acid; the remainder, 58%, is presumably in the form of α-phenylaminopropionic acid or its polypeptide.

The destruction of the benzene ring by carnivorous animals is attributed to the co-operation of acid products, due to animal food. Indications were obtained in experiments with a calf, fed with milk, of the breaking up of the benzene ring. N. H. J. M.

Effect of Carbon Dioxide on the Frog's Pupil. John Auer (*Proc. Amer. physiol. Soc.*, 1908, xvi; *Amer. J. Physiol.*, 23).—In asphyxia the pupils of mammals are dilated. In the frog, exposure to carbon dioxide causes extreme contraction; this also occurs in the isolated eyeball. The gas is, however, unable to overcome fully the opposite effect produced by adrenaline, and adrenaline is unable to exert its full effect when the iris is under the influence of carbon dioxide. W. D. H.

Autolysis. S. Yoshimoto (*Zeitsch. physiol. Chem.*, 1909, 58, 341—368).—The commonly used preservatives, boric and salicylic acids, hasten fermentation actions in the liver at certain small "optimum" concentrations; excess slows or stops the action. The same is true for allylthiocarbimide and alcohol, although the actual figures of optimum concentration are naturally different in all cases. Normal autolysis and that which is produced by carbon dioxide in chloroform water run the same course; there is no lessening of the yield of purine bases, such as is said to occur with other acids. The following table gives the optimum concentrations of the substances mentioned, together with the amount of autolysis as judged by the proportion of the total nitrogen going into solution under similar conditions:

	%.
Chloroform water (taken as the normal)	21·59
Alcohol (concentration 5%)	32·01
Allylthiocarbimide (concentration 1/8%, saturated solution)	38·78
Boric acid (concentration 1%)	40·80
Salicylic acid (concentration, half saturated solution)	47·37

W. D. H.

Heat-coagulation in Plain Muscle. EDWARD B. MEIGS (*Proc. Amer. physiol. Soc.*, 1908, xv—xvi; *Amer. J. Physiol.*, 23).—In both plain and striated muscle of the frog, irritability is lost about 40°; the shortening of striated muscle is marked at 50°, but at this temperature the plain muscle lengthens. In both cases the protein is coagulated, and lactic acid liberated; the swelling of the sarcostyles in the case of striated muscle so produced causes shortening, whereas the swelling of the plain fibre with a different histological structure produces lengthening. W. D. H.

The Influence of Sodium Chloride and Calcium Chloride in the Potassium Contraction. WILLIAM D. ZOETHOUT (*Amer. J. Physiol.*, 1909, 23, 374—388).—The amount of sodium in a muscle is sufficient to counteract the stimulating effect of a small quantity of potassium salt. The removal of this sodium by immersion in a 6% sugar solution renders the muscle more irritable toward potassium; the same is probably true for calcium. Both sodium and calcium favour the relaxation of a muscle in potassium contraction. Ringer's solution, and 0·7% sodium chloride solution, speedily reduce the irritability of muscle toward potassium. Although such solutions preserve muscular irritability toward electrical stimulation for a long time, they cannot be regarded as altogether inert fluids. W. D. H.

The Influence of Salts of Strong Organic Bases on the Resting Current and Excitability of Frog's Muscle. RUDOLF HÖBER and HEINRICH WALDENBERG (*Pflüger's Archiv*, 1909, 126, 331—350).—The salts of quaternary ammonium bases, piperidine, guanidine, and trimethylsulphine, that is, of strong organic bases, affect the resting current and excitability of frog's muscle in the same way as do salts of strong inorganic bases, and most closely resemble the effects of cæsium salts. The action is a reversible one. The resting current and excitability are both affected in the same way. W. D. H.

Cholesterol in Heart Muscle. G. W. Ellis and John A. Gardner (*Proc. physiol. Soc.*, 1908, viii—x; *J. Physiol.*, 38).—The amount of cholesterol in heart muscle is approximately the same as in other kinds of muscular tissue. W. D. H.

Cycloses. Franz Rosenberger (*Zeitsch. physiol. Chem.*, 1909, 58, 369—372).—Polemical. A reply to Starkenstein (this vol., ii, 77). W. D. H.

Black Cephalopod Inks. Raffaele Paladino (*Biochem. Zeitsch.*, 1909, 16, 37—44).—The black excretion of *Eledone moscata* has the following composition: water 40, soluble mineral substances 4·06, soluble organic substances 2·32, insoluble mineral substances 6·67, insoluble organic material 40 6%. The secretion of *Sepia officinalis* has the values: water 20, soluble mineral 8·5, soluble organic 3·5, insoluble mineral 15·0, insoluble organic 34·0%. The composition of the black insoluble pigment, melanin, is C 52·4, H 4·02, N 5·6%, together with sulphur and iron.

The following were shown to be present in the inks: sodium, potassium, calcium, iron, chloride, carbonate, and sulphate. Urea, uric acid, and dextrose could not be detected. J. J. S.

Parent Substance of Hippuric Acid. Haralamb Vasiliu (*Bied. Zentr.*, 1909, 38, 132—133; from *Mitt. landw. Inst. K. Univ. Breslau*, 1908, 4, 374—378. Compare Abstr., 1908, ii, 211).—The hippuric acid produced from clover hay is derived partly (3/5) from proteins and partly (2/5) from a non-nitrogenous substance. In the case of meadow hay the amount produced from non-nitrogenous substances is fifteen times as great as the portion derived from proteins. It seems probable that as regards foods, such as leguminous foods, oil cakes, etc., which give rise to relatively small amounts of hippuric acid, most of the acid is derived from proteins, whilst in the case of foods which furnish large amounts of the acid, its production is mainly from non-nitrogenous substances. The parent substance in the latter case seems to contain a hydroxylated benzene ring; it is possibly quinic acid, which is always present in meadow hay, and yields in the animal body 36% of the theoretically possible amount of hippuric acid. N. H. J. M.

The Influence of Calcium Chloride on the Formation of Transudates. Leo Loeb, S. M. Fleischer, and D. M. Hoyt (*Zentr. Physiol.*, 1908, 22, No. 16, reprint).—The addition of calcium chloride to 0 85% salt solution, diminishes the rate of excretion of liquid by the kidneys, and also into the intestine, when the solution is injected intravenously into rabbits. It increases, on the other hand, the rate of transudation into the peritoneal cavity. The latter action is due to two factors, namely, the indirect factor, which results from diminished kidney excretion, and the direct factor, due to the action of the calcium salt on the endothelium of the vessels or peritoneum. The latter can take place when the action of the kidneys is excluded. S. B. S.

Phosphorus of Urine. G. C. Mathison (*Proc. physiol. Soc.*, 1909, xx—xxii; *J. Physiol.*, 38).—The total phosphorus was estimated by

Bayliss and Plimmer's modification of Neumann's method, and inorganic phosphates by precipitation with magnesia mixture; the difference represents organic phosphorus. The latter represents 5 to 10% of the total, a higher figure than has been previously obtained. W. D. H.

Excretion of Magnesium and Calcium. LAFAYETTE B. MENDEL and STANLEY R. BENEDICT (*Proc. Amer. physiol. Soc.*, 1908, xviii; *Amer. J. Physiol.*, 23).—When magnesium salts are introduced parenterally, elimination occurs through the urine in about forty-eight hours, although some may be retained for two weeks. There is no purgation. There is accompanying this an increased excretion of calcium by the kidney and a lessened excretion of calcium by the bowel. Nitrogen and chlorine are not appreciably altered.

If calcium salts are introduced into the circulation, the calcium, especially in rabbits, is abundantly excreted in the urine; this is accompanied by an increased output of magnesium W. D. H.

Acetone Substances in the Organs of Cases of Diabetic Coma. II. H. CHRISTIAN GEELMUYDEN (*Zeitsch. physiol. Chem.*, 1909, **58**, 255—272. Compare Abstr., 1904, ii, 275).—The investigations of the amounts of acetone substances were made in surviving organs; during the life of diabetics, other relationships may prevail. The view put forward is that during life β-hydroxybutyric acid is formed mainly in the liver; it is thence carried by the blood to other organs, and taken up by them; the increase of fat metabolism, owing to the small amount of carbohydrate metabolism, leads to a greater production of the acid than occurs in health; but as it leaves the liver for distribution, the amount remaining in the liver is comparatively small. The formation of the acid and its conversion into acetoacetic acid are oxidation processes. In diabetes, the glycogenic function of the liver is in abeyance, and little or none of the substance is found there. W. D. H.

Experimental Nephritis. JOHN LIGHTERWOOD GREEN (*J. Path. Bact.*, 1909, **13**, 296—310).—In nephritis produced in rabbits by potassium chromate the quantity of urine on the first two days sinks to 50% of the normal, and then gradually returns to normal. The protein rises to maximum on the second day, and then gradually disappears. The protein consists of albumin and globulin, in inconstant proportions. In a dog the total nitrogen was reduced by 20%, the chlorides by 50%, the creatinine was slightly reduced, and the phosphates were unaltered. In three cases of the disease in man, the urea nitrogen was found to follow the total nitrogen, but there is no constancy in the reduction of either; in two cases the ammonium excretion was low, and in the third, high; the creatinine was slightly reduced in two cases. In the blood in the experimental cases there was a fall of 14% in the red corpuscles on the onset of nephritis, and a rise of 43% in the colourless corpuscles (especially of polynuclear leucocytes); the return to normal was gradual. W. D. H.

Effect of Calcium on the Cardiac Vagus. JOHN AUER and SAMUEL J. MELTZER (*Proc. Amer. physiol. Soc.*, 1908, xx—xxi; *Amer. J. Physiol.*, 23).—Calcium restores the irritability of the cardiac vagus in animals poisoned by magnesium salts, but in the normal animal calcium infused in $M/8$ solutions reduces or even abolishes the irritability of the inhibitory fibres of this nerve, leaving its motor fibres unaffected. W. D. H.

The Behaviour of Phthalic Acid in the Animal Organism. Julius Pohl (*Biochem. Zeitsch.*, 1909, 16, 68—70).—Porcher states that 75% of *iso*phthalic and terephthalic acids appear in the urine, whilst phthalic acid is almost completely burnt in the organism of the dog. The last statement is in contradiction of work by Pribram. The present experiments confirm the observation of Pribram that the ortho-acid is almost completely recoverable in dog's urine. W. D. H.

Pressor Substances from Putrid Meat. George Barger and George S. Walpole (*Proc. physiol. Soc.*, 1909, xxiii; *J. Physiol.*, 38).—The presence of a substance or substances producing a rise of arterial pressure has been noted by Abelous in putrid meat, and by Dixon, Taylor, and Rosenheim in putrid placenta. Two substances was separated from putrid meat, namely, *iso*amylamine and *p*-hydroxyphenylethylamine; both are pressor substances, especially the latter. The relation of these two bases to leucine and tyrosine respectively is clear, and the possibility of their formation in the intestine is of interest. W. D. H.

Physiological Action of Primary Fatty Amines. George Barger and Henry H. Dale (*Proc. physiol. Soc.*, 1909, xxii; *J. Physiol.*, 38).—Barger and Walpole's work (see preceding abstract) suggested the examination of other amines. The following were tested: methylamine, ethylamine, *n*-propylamine, *iso*propylamine, *n*-butylamine, *iso*butylamine, *iso*amylamine, *n*-amylamine, *n*-hexylamine, *n*-heptylamine, and *n*-octylamine. The hydrochlorides were used in all cases in $N/10$ solution. The first to give a pressor effect is *iso*butylamine; the activity rapidly increases on ascending the series up to hexylamine; those still higher, show a decreasing action. W. D. H.

Action of Digitalin and Allied Substances on Striated Muscle. Augustus D. Waller (*Proc. physiol. Soc.*, 1908, x—xvi; *J. Physiol.*, 38).—Natroello's digitalin has no action on muscle; Merck's digitonin cryst., digitalinum pulv. pur. (Merck), digitalinum venum (Schmiedeberg), and digitoxin (Merck) were also employed. The last-named has also no action; the other three vary in degree of activity, but all produce characteristic effects, namely, well-marked contraction and loss of contractility. The action of saponin is very similar. W. D. H.

Action of Muscarine and Pilocarpine on the Heart. Hugh MacLean (*Bio-Chem. J.*, 1909, 4, 66—71).—The effect of these drugs is to be ascribed to their stimulating influence, doubtless by chemical interaction on the nerve endings of the inhibitory nerve fibres of the heart. W. D. H.

The Passage of Phenolphthalein and of its Disodium Derivative Through the Organism. C. Fleig (*J. Pharm. Chim.*, 1909, [vi], 29, 55—57. Compare Abstr., 1908, ii, 313).—When given by the mouth, 85% of the phenolphthalein is found in the fæces; it does not appear in the urine unless very large quantities are given *per os*, or unless it is administered hypodermically or intravenously. Phenolphthalein is never hydrolysed in the tissues, but probably passes into the urine in combination with sulphuric or glycuronic acid. G. B.

Atoxyl. III. Ferdinand Blumenthal and Ernst Jacoby (*Biochem. Zeitsch.*, 1909, **16**, 20—36).—The introduction of acid radicles (for example, acetyl) into the amino-group of the sodium salt of *p*-aminophenylarsinic acid (atoxyl) lessens its toxicity; the introduction of a methyl group does not. Complete substitution of the amino-group by iodine increases the toxic action; as also does its replacement by hydroxyl (Ehrlich). The toxicity of the mercury salt depends on the amount of mercury given. Reduction products of atoxyl are more toxic than atoxyl itself.

In the body, atoxyl acts directly as an antiseptic. Details are given regarding its deposition in the tissues, and its excretion in the urine. W. D. H.

The Present State of Chemotherapeutics. Paul Ehrlich (*Ber.*, 1909, **42**, 17—47).—A lecture delivered before the German Chemical Society. C. S.

Chemistry of Vegetable Physiology and Agriculture.

Ammoniacal Fermentation. Jean Effront (*Compt. rend.*, 1909, **148**, 238—240).—The author gives details of some experiments which throw light on the function of butyric ferments in the conversion of atmospheric nitrogen into a form assimilable by plants. Distillery residues sown with an earth culture undergo symbiotic fermentation through the action of aerobic ferments and an anaerobic butyric ferment. The latter has been isolated, and its action studied on dextrose solutions containing various amino-acids. In the case of aminoacetic acid, asparagine, and glutamic acid, the ammonia formed was free from amines, but when betaine was present, pure trimethylamine was obtained. Distillery residues gave ammonia and trimethylamine. The ammoniacal fermentation in each case proceeded at the same rate as the destruction of the dextrose. Analogous results were obtained using ordinary earth in place of the pure culture, but the action was more rapid and complete. W. O. W.

Decomposition of Nitrates by Bacteria. S. A. Sewerin (*Centr. Bakt. Par.*, 1909, ii, **22**, 348—370. Compare Abstr., 1900, ii, 232).—Under anaerobic conditions (in an atmosphere of hydrogen) the denitrifying power of *Vibrio denitrificans* is increased, whilst in the case of *Bacillus pyocyaneus* there is a still more marked increase. Nitrites are also reduced under anaerobic conditions by both organisms, although less readily than nitrates.

In the reduction of nitrates by *B. pyocyaneus* there is always a production of nitrites, both in aerobic and anaerobic cultures. With *Vibrio denitrificans*, nitrites could not be detected in the majority of cases, and, when present at all, generally showed a less distinct reaction.

The reducing power of both organisms is diminished when hydrogen is replaced by carbon dioxide; and *B. pyocyaneus* failed to grow in broth free from nitrates in an atmosphere of carbon dioxide.

Results of experiments with different soils indicated that a total destruction of nitrates does not take place in soils in their natural condition. Addition of 2% of horse dung and 4% of straw to garden soil and other soils resulted in complete reduction of nitrates by *B. pyocyaneus*. With *V. denitrificans* complete reduction only occurred in one soil, a marl to which 8% of dung had been added. Nitrites were not found in any of the experiments with soils.

N. H. J. M.

Use of Silver Salts in Sterilising Water. F. Traetta-Mosca (*Gazzetta*, 1909, **39**, i, 69—109).—The author has examined *iso*tachyol and silver chlorate, perchlorate, and sulphate in regard to their powers of disinfecting water (compare Paterno and Cingolani, Abstr., 1907, ii, 713).

All these compounds exhibit marked germicidal characters, and can be advantageously employed for the sterilisation of drinking water, pathological organisms, such as those of cholera, typhoid, and dysentery, being rapidly destroyed by very small proportions of the disinfectant.

This bactericidal action, which is exhibited to a far greater degree by *iso*tachyol than by the other silver compounds examined, depends principally, although not entirely, on the silver ions. According to D'Anna (*Arch. Farm. sper. sci. affini*, 1904), the acid radicle of a metallic salt influences the disinfecting action of the latter only in so far as it varies the proportion of active metal present. But the author's results are not in agreement with this view, since silver sulphate, containing 69·2% of silver, is inferior as a sterilising agent to the chlorate and perchlorate, containing 56·3 and 52·0% of silver respectively.

T. H. P.

The Rôle of Oxalate in the Germination of Beet Seed. G. Doby (*Landw. Versuchs-Stat.*, 1909, **70**, 155—158).—During germination the alkali oxalate disappeared completely, whilst the amount of calcium oxalate remained unchanged. Only the former substance can therefore be considered as reserve material.

N. H. J. M.

Chemical Nature of Root Secretions. Julius Stoklasa and Adolf Ernest (*Jahrb. wiss. Bot.*, 1908, **46**, 55—102. Compare Abstr., 1905, ii, 607).—Water-culture experiments with maize, oats, and buckwheat showed that when oxygen is deficient, the roots secrete very marked amounts of fatty acids (formic and acetic acids). In the case of barley there was only a slight production of acids. Sugar beet secreted oxalic and acetic acids. Under conditions of abundant aeration, no acids are secreted, being oxidised to carbon dioxide within the roots; in some cases, traces of hydrogen were given off along with the carbon dioxide. No secretion of mineral acids took place either under conditions of aeration or without aeration.

The amount of carbon dioxide given off by roots varies considerably with different plants. Of the various plants employed, barley produced the greatest amount of dry matter in roots, and also gave off the greatest amount of carbon dioxide. When, however, the amount of carbon dioxide given off in twenty-four hours is expressed in mg. per gram of dry matter, it is seen that barley produces the smallest amount. The quantities for the different plants are as follows: barley, 63·2—74·6; oats, 111·5—135·4; wheat, 87·6—94·8, and rye, 100·7—131·0 mg. CO_2 per gram.

In accordance with these results, it was found that when the four plants were grown in powdered gneiss and in basalt manured with ammonium nitrate, sulphate, and chloride, barley produced the least growth and assimilated the smallest amount of potassium and phosphoric acid, whilst oats produced the greatest amount of dry matter. All the plants, as was also the case with water saturated with carbon dioxide, extracted more mineral matter from basalt than from gneiss. N. H. J. M.

Significance of the Colloidal Nature of Aqueous Dye-solutions for their Penetration into Living Cells. WILLY RUHLAND (*Ber. Deut. bot. Ges.*, 1908, 26a, 772—782).—A study of the colloidal nature of dyes does not lead the author to modify his criticism of Overton's theory, according to which theory the cell wall is a semi-permeable lipoid membrane. The rate at which various dyes (both basic and acidic) are taken up by living cells bears apparently no relation to the degree of colloidity of their aqueous solutions. G. B.

Amounts of Iron and Phosphorus in Vegetables. E. HAENSEL (*Biochem. Zeitsch.*, 1909, 16, 9—19).—Determinations of dry matter, ash, iron, and phosphorus in twenty-four vegetables and fruits. N. H. J. M.

Loss of Nitrates and of Hydrogen Cyanide during the Desiccation of Plants. E. COUPEROT (*J. Pharm. Chim.*, 1909, [vi], 29, 100—102).—Experiments with the leaves and other parts of *Sambucus nigra*, *S. laciniata*, and *S. racemosa* show that when these are allowed to dry by mere exposure to the air at atmospheric temperature, the quantity of nitrates present may be reduced by from 20 to 50%. The first two species also yield hydrogen cyanide, and the quantity of this substance obtainable from the fresh parts of these plants is similarly reduced after air-drying. On the contrary, if the fresh parts of these plants are placed immediately in a drying apparatus at 60° and maintained at this temperature until dry, there is no loss of nitrates or of hydrogen cyanide. The conclusion is drawn therefore that the losses referred to are due to the utilisation of nitrates and cyanogenetic products by the living cells as reserve materials. T. A. H.

Composition of Amapa latex. A. Rathje (*Arch. Pharm.*, 1909, **247**, 49—53).—This latex (sp. gr. 1·0304), which is used by the South American Indians in the Amazon valley as a remedy for consumption, is probably derived from a *Hancornia* sp. It is acid in reaction and taste, and contains neither alkaloids nor glucosides. The resinous product obtained on coagulation has m. p. 45°, saponification number 96·4 (156·7 when saponified under pressure), iodine number (Wys' method) 39·3—53·4, depending on the time the product is left in contact with iodine solution, and Reichert-Meissl number 9·2. It contains gum, sugars, water, formic, acetic, propionic and butyric acids, fatty acids melting at 53—54°, 63—64°, 69—70°, and 78—79°, phytosterol, and other fatty alcohols and hydrocarbons or their near allies, having m. p. 120—121°, 196—197°, 200—201°, and 205—206°.

T. A. H.

Maltase of Maize. R. Huerre (*Compt. rend.*, 1909, **148**, 300—302).—The discrepancies in the observations of various authors are due to the dissimilarity of the ferment in different varieties. The (ungerminated) seeds from one variety of maize from the Landes ("blanc hâtif") have a maltase acting between 0° and 65°, with optimum at 40° (and an amylase with a much lower optimum temperature). Another variety of maize ("jaune hâtif") has a maltase acting between 20° and 80°, with optimum at 60—62°. G. B.

Pentosans of Soja hispida. G. Borghesani (*Bied. Zentr.*, 1909, **38**, 141; from *Staz. sper. agrar. ital.*, 1907, **40**, 118).—The following percentage results are given:

	Furfur-aldehyde.	Pentose.	Pentosan.
Soja hispida tumida, var. *pallida*	1·67	3·25	2·86
,, ,, *platycarpa*, var. *pallida*	1·74	3·38	2·97
,, ,, ,, ,, *melanosperma*.	2·26	4·39	3·86
,, ,, ,, ,, *castanea*	2·15	4·17	3·67
,, (green)	2·11	4·09	3·60

N. H. J. M.

Is the Omission of Magnesium in Soil Analysis Justifiable? Oscar Loew (*Chem. Zeit.*, 1909, **33**, 118—119).—Attention is called to the importance of determining magnesium in soil in addition to potassium, calcium, phosphoric acid, and nitrogen. Experiments on the effect of magnesium manures have frequently been made without ascertaining the amount already present in the soil. A large number of soils in the Rhine Palatinate were found by Kling to contain only 0·04—0·06% MgO, whilst more than half contained only traces, and some none at all. On the other hand, a soil near Munich contains over 10% MgO (as dolomite).

The frequently discordant results of experiments on the relative values of sodium and calcium nitrates are attributed, in part, to varying relations of the amounts of calcium and magnesium in the soil. Soil already containing a high relation of calcium to magnesium would be injured by further applications of calcium, especially when in a readily available form such as nitrate. N. H. J. M.

Decomposition of Soil-producing Rocks. EMIL HASELHOFF (*Landw. Versuchs-Stat.*, 1909, **70**, 53—143).—Gramineous and leguminous plants are able to produce more or less growth in freshly-broken unweathered rocks, such as basalt, muschelkalk, etc. Of the two groups, the leguminous plants, owing to their greater range of roots and their power of utilising atmospheric nitrogen, have a much greater power of obtaining nutrients from the minerals than gramineous plants. The different plants of the two groups also vary in this respect among themselves.

Addition of nitrogenous manures distinctly increased the yields and also the amounts of nitrogen in the plants; there was, however, no increase in the amounts of other constituents. N. H. J. M.

Diffusion of Manurial Salts in Soil. ACHILLE MÜNTZ and H. GAUDECHON (*Compt. rend.*, 1909, **148**, 253—258).—When soluble salts, such as sodium nitrate and potassium chloride, are applied to air-dried soils in small patches, the soil gradually darkens in the places containing the salt, owing to deposition of moisture from the surrounding portions. Determinations of moisture after a week or ten days showed that the parts of the soil to which the salts were applied contained more, whilst the intermediate portions contained less, moisture than was originally present. In the case of potassium chloride it was found that in ten days no lateral diffusion had taken place to a distance of 20 mm., whilst the soil of the spot to which the salt had been applied contained 1·48%. These results are considered to explain the failure of crops when the seed and manure have been sown about the same time in dry weather; some of the seeds become surrounded by concentrated solutions of salts, whilst the remaining seeds fail to germinate because of the diminished amount of water.

Similar experiments with a wet soil (containing 15·6% water), which received at different points 2 grams of sodium nitrate and potassium chloride at a depth of 1 cm., showed that in six days no appreciable lateral or vertical diffusion had taken place at a distance of 25 mm. In another experiment in soil containing 16·1% of water, a slight diffusion at a distance of 20 mm. was detected at the end of a month, but not at 40 mm.

When rain falls, the solutions of the particles are carried straight down without appreciable lateral diffusion of the salts. It is only during very prolonged falls of rain that a gradual distribution of the salts occurs.

Under ordinary conditions, the diffusion of salts in the soil is extremely slow. N. H. J. M.

Physiological Characterisation of Ammonium Salts. DMITRI PRIANISCHNIKOFF (*Ber. Deut. bot. Ges.*, 1908, **26a**, 716—724).—The partial replacement of sodium nitrate by ammonium sulphate in sand cultures has a beneficial effect on the absorption of crude phosphates, but when the whole of the nitrogen is supplied as ammonium sulphate the "physiological acidity" of the latter salt acts unfavourably, and calcium carbonate must be added in order to neutralise the sulphuric acid set free. The calcium carbonate can be replaced by sodium nitrate, but only partly by ammonium nitrate. G. B.

Properties and Action of Ammonium Sulphate Containing an Excess of Sulphuric Acid. OTTO LEMMERMANN (*Bied. Zentr.*, 1909, 38, 15—17; from Fühling's *Landw. Zeit.*, 1908—9.).—The two chief varieties of ammonium sulphate contain excess of sulphuric acid amounting to 1—1·5 and 0·5% respectively. The presence of hydrogen ammonium sulphate, even when the excess of sulphuric acid reaches the amount of 3%, does not render the manure appreciably more hygroscopic, whilst the results of pot experiments with barley failed to show any injurious action. N. H. J. M.

Manurial Experiments with the Two Commercial Forms of Calcium Cyanamide and with Calcium Nitrate. BR. STEGLICH (*Verhandl. Ges. deut. Naturforsch. Aertze.*, 1907, II, 147—150).—Experiments on various crops from 1903 to 1907, in which the action of the three manures is compared with that of sodium nitrate and in most cases with ammonium sulphate as well.

The results vary considerably in different years. The averages over the whole period indicated that "kalkstickstoff" has a value of 96 as compared with sodium nitrate = 100 and ammonium sulphate = 95. "Stickstoffkalk," which was only included in the experiments of 1906 and 1907, and calcium nitrate (1907) showed values of 94 and 101 respectively.

The percentage of nitrogen in a sample of "kalkstickstoff" which was kept for three years fell from 18·5 to 12. N. H. J. M.

Manurial Experiments with Calcium Cyanamide. JOHANNES BEHRENS (*Bied. Zentr.*, 1909, 38, 67; from *Ber. landw. Versuchsstat. Augustenberg*, 1906, 40).—Field experiments with barley, in which calcium cyanamide was applied a week before the seed was sown, showed an increase of about 20% of grain as compared with the unmanured plot, whilst sodium nitrate more than doubled the yield.

When applied as a top-dressing to buckwheat and barley, the former was injured beyond recovery, whilst the latter, although injured at first, recovered later on. N. H. J. M.

Action of Calcium Cyanamide on Carrots, Kohl-rabi, and Mangolds under Damp Climatic Conditions. ALBERT STUTZER (*Bied. Zentr.*, 1909, 38, 104—106; from Fühling's *Landw. Zeit.*, 1908).—Sodium nitrate, ammonium sulphate, and calcium cyanamide applied to carrots gave similar results as regards total dry matter, whilst the relations of roots to leaf varied, sodium nitrate producing the greatest amount of leaf and cyanamide the most root (both as dry matter). The cost of producing an increase of 10 kilos.

of dry matter (roots) of carrots, kohl-rabi, and mangolds was less when calcium cyanamide was employed than with sodium nitrate.

The rainfall had been excessive in June, July, and August, and August was cold and windy. N. H. J. M.

Action of Calcium Nitrate and Calcium Cyanamide on Peat Soils. Hjalmar von Feilitzen (*Mitt. Ver. Förd. Moorkultur*, 1909, Heft. 1 and 2; and *Svenska Mosskulturför. Tidskr.*, 1909, No. 1).—Calcium nitrate applied to oats, potatoes, and hemp grown in peaty soil deficient in nitrogen and in sandy soil gave results equal to those obtained with sodium nitrate; in some cases calcium nitrate produced higher yields than sodium nitrate.

Calcium cyanamide yielded good results when applied to different peaty soils. As compared with sodium nitrate the yields were sometimes higher and sometimes lower. When used for grass, it should be applied some time before the commencement of growth to avoid injurious action. N. H. J. M.

Manurial Experiments with Calcium Nitrate on Potatoes. Albert Stutzer (*Bied. Zentr.*, 1909, **38**, 138—139; from *Mitt. deut. landw. Ges.*, 1908, St. 4, 19).—Equal amounts of nitrogen as sodium and calcium nitrates gave equally increased yields of tubers. The greatest amount of starch was produced by 50 kilos. of nitrogen per hectare as sodium nitrate, and the next largest amount by 25 kilos. of nitrogen as calcium nitrate. Larger amounts of calcium nitrate reduced the amount of starch.

In experiments with tobacco, calcium nitrate acted very favourably on leaf development, and the burning quantity of the leaf was better than with sodium nitrate. N. H. J. M.

Amount and Composition of the Drainage Waters Collected during the Year 1907–8. B. C. Burt (*Rep. Cawnpore Agric. Stat.*, for the year ending June 30, 1908, 18—19. Compare Abstr., 1908, ii, 890).—The total amounts of rain and drainage, and of nitrogen as nitrates in the drainage, from June 1 to October 31, were as follows:—

No.	Depth of soil in inches.	Rainfall, inches.	Drainage, inches.	Nitrogen as nitrates.	
				Per million.	lb. per acre.
1......	72	17·15	3·645	11·70	9·65
2......	72	17·15	4·844	12·61	13·83
3......	36	17·15	5·920	24·26	32·49
4......	36	17·15	6·756	24·30	37·15

N. H. J. M.

Use of Ferrous Arsenate against Insect Parasites of Plants. Vermorel and Dantony (*Compt. rend.*, 1909, **148**, 302—304).—A 4% solution of crystallised ferrous sulphate is slowly added to a 4% solution of sodium arsenate until a potassium ferro- or ferri-cyanide test-paper is turned blue; the mixture is then diluted with four volumes of water, so that it contains about 0·2% of ferrous arsenate, and is used as a spray. It is much less toxic to plants than the alkali arsenates, and adheres better than Scheele's or Schweinfurth's green. G. B.

Analytical Chemistry.

Automatic Sampler and Mixing Apparatus. O. Binder (*Zeitsch. anal. Chem.*, 1909, 48, 32—35).—For fairly uniform samples the apparatus consists of a channel or gutter provided with a number of funnels; the sample is placed in a separate funnel, the stem of which is closed with the finger, and, by moving the finger, the sample is allowed to run into the channel and thence through the funnels into bottles placed below the funnels. If the sample is large and consists of pieces of widely varying sizes, it should be introduced into a chamber divided into four compartments by means of diagonal partitions; two of the "quarterings" thus obtained are mixed, re-distributed over the apparatus, and so on, until a conveniently small average sample has been obtained. This sample may then be divided into smaller parts by means of a funnel and dividing plates. W. P. S.

Weighing Hygroscopic Substances in the Open. R. Hottinger (*Zeitsch. anal. Chem.*, 1909, 48, 73—78).—It is shown that the weight of hygroscopic substances may be obtained in open vessels by weighing the substance, dried previously, several times at regular intervals. By plotting a curve showing the increase of weight at definite intervals of time, the correct weight of the dry substance may be obtained by extrapolation. W. P. S.

Gravimetric Estimation of Halogens by means of Silver Nitrate. Ernst Alefeld (*Zeitsch. anal. Chem.*, 1909, 48, 79—80). —A precipitate which filters readily and is free from turbidity is obtained if about 5 c.c. of ether be added to the halogen solution acidified with nitric acid before the addition of the silver nitrate solution. The precipitate should be collected on a Gooch filter moistened previously with ether. W. P. S.

Iodine Compounds and Gold Solutions. C. J. Reichardt (*Pharm. Zeit.*, 1909, 54, 58).—If a few drops of 1% auric chloride are added to a little of a very dilute solution of potassium iodide, iodine is liberated, particularly on heating to boiling. If, when cold, the liquid is shaken with chloroform, this turns violet. If potassium bromide is present, yellow crystals will be found floating on the chloroform. The process is suitable for the detection of traces of iodides in commercial bromides; a 1% sodium aurichloride solution is then employed.

If to a few drops of a 1% sodium aurichloride solution are added 8 c.c. of water and then a drop of a freshly-prepared 0·5% potassium iodide solution, the liquid on heating shows a yellow opalescence, but remains clear in transmitted light. If now are added substances capable of reducing gold, and the heating is continued for about half a minute, characteristic colorations are noticed. It is remarkable that lactose, unlike dextrose, gives no reduction. A list is given of some homeopathic compounds which give colorations varying from violet to dark blue. The colours should be observed in transmitted and also in incident light, and compared with a similar liquid to which lactose has been added. L. DE K.

Colorimetric Estimation of Dissolved Oxygen in Water. GEORGE B. FRANKFORTER, G. W. WALKER, and A. D. WILHOIT (*J. Amer. Chem. Soc.*, 1908, 31, 35—43).—An apparatus is described with which the colorimetric estimation of dissolved oxygen by means of ammoniacal cuprous chloride, according to Ramsay and Homfray (Abstr., 1902, ii, 171), can be made with considerable accuracy. The essential parts of the apparatus are constructed entirely of glass, and the mixing of the cuprous chloride and ammonia is effected in the apparatus itself. A few experiments have been made on the rate at which oxygen is absorbed by water. G. S.

Estimation of Sulphur in Urine. EMIL ABDERHALDEN and CASIMIR FUNK (*Zeitsch. physiol. Chem.*, 1909, 58, 331—333).—The statement of Osterberg and Wolf that Schulz's method gives too low results is confirmed. Good results are obtained if the oxidation of the urine is effected with sodium peroxide. W. D. H.

Estimation of Total Sulphur in Urine. F. W. GILL and HARRY S. GRINDLEY (*J. Amer. Chem. Soc.*, 1909, 31, 52—59).—Experiments showing that there is a loss of sulphur attending the estimation of this element in urines when the sodium peroxide methods or other alkaline fusion methods are resorted to. The loss may amount to 10%, or even more, of the total sulphur present.

L. DE K.

Estimation of Total Sulphur in Urine. OTTO FOLIN (*J. Amer. Chem. Soc.*, 1909, 31, 284—285).—A reply to Gill and Grindley's criticism (preceding abstract) on the author's sodium peroxide method for the estimation of the total sulphur in urine (Abstr., 1906, ii, 124).

E. G.

Estimation of Sulphide in Alkali Cyanides. THOMAS EWAN (*J. Soc. Chem. Ind.*, 1909, 28, 10—13).—A critical examination of several methods of estimating small quantities of sulphide in solid cyanides. (1) Ten grams of the cyanide are dissolved in 15 c.c. of water and the sulphide titrated by a standard lead nitrate solution until a drop of the solution no longer gives a brown stain when brought in contact with a drop of the lead solution on filter paper. This is a rapid works' method; the chief error is due to oxidation of the sulphide by atmospheric oxygen, which is much accelerated by the lead. The results when multiplied by 1·25 are sufficiently accurate.

(2) Colorimetric methods, using lead sulphide, are only correct when the two solutions compared are of identical composition, and when oxidation is avoided or made to affect both solutions equally. A method described by G. W. Williams fulfils these conditions (*J. Chem. Metall. Min. Soc. S. Africa*, 1905, 6, 170). W. Feld's method, in which the sample is distilled with excess of magnesium chloride in a current of carbon dioxide, the hydrogen sulphide evolved being collected in standard iodine solution, is also accurate, but somewhat troublesome.

T. E.

Titration of Sulphites with Permanganate. JAROSLAV MILBAUER (*Zeitsch. anal. Chem.*, 1909, 48, 17—24).—Owing to the fact that sulphurous compounds are not completely oxidised to sulphuric acid by means of permanganate, the estimation of sulphites by direct titration with permanganate solution is untrustworthy. Results may be obtained, however, which agree well with those found on titration with iodine, if a very dilute solution of the sulphite is added to ten times the required quantity of permanganate solution, acidified with more than 20% (by volume) of concentrated sulphuric acid, and the excess of permanganate then titrated with standard oxalic acid, ferrous sulphate, or hydrogen peroxide solution. The excess of permanganate cannot be titrated with thiosulphate solution after the addition of potassium iodide. The addition of a trace of iodine or bromine has a favourable influence on the oxidation.

W. P. S.

Qualitative Analysis of Sulphates, Sulphites, and Thiosulphates. WLADIMIR ALEXANDROFF (*Zeitsch. anal. Chem.*, 1909, 48, 31—32).—The method described for the separation and identification of sulphates, sulphites, and thiosulphates in the presence of each other depends on the different solubilities of barium sulphate, sulphite, and thiosulphate, and on the fact that silver thiosulphate decomposes at the ordinary temperature with the formation of silver sulphide, whilst silver sulphite remains unaltered. About 0·1 gram of the mixed salts is dissolved in water, and the boiling solution is treated with an excess of barium nitrate solution; when quite cold, the precipitate, consisting of barium sulphate and a little barium sulphite, is collected on a filter, washed, and tested in the usual way for sulphite. The filtrate is treated with silver nitrate solution, and the mixture is set aside for about forty minutes or until the silver thiosulphate has decomposed. Ammonia is then added, the silver sulphide is removed by filtration, and the filtrate is acidified with hydrochloric acid. The silver chloride is collected on a filter, and the filtrate is treated with bromine after the addition of ammonium chloride. The sulphite is thus oxidised, and a precipitate of barium sulphate is formed. W. P. S.

Simple Method of Estimating the Nitrogen as Nitrates and Nitrites in Mixtures and in Presence of Organic Matter. T. ZELLER (*Landw. Versuchs-Stat.*, 1909, 70, 145—154).—The solution containing nitrates and nitrites is boiled with a measured amount of a solution of ammonium chloride of known strength

(3—4%) in a 100 c.c. flask until about 2 c.c. remains. The residue is diluted to 100 c.c. The nitrogen as ammonium chloride still remaining is determined in 40 c.c. by boiling with magnesia. The difference between the initial amount of ammonium chloride and the amount of ammonium recovered represents the nitrogen as nitrites. A second 40 c.c. is reduced with sulphuric acid and iron, and distilled with sodium hydroxide. The result obtained less the first result gives the amount of nitrogen as nitrate.

Carbonates, when present, must be precipitated with barium chloride before treatment with ammonium chloride.

Results of a considerable number of estimations in weighed amounts of sodium nitrite, both alone and in presence of other substances, inorganic and organic, show that the method is trustworthy.

N. H. J. M.

Gravimetric Estimation of Nitric Acid. A. Hes (*Zeitsch. anal. Chem.*, 1909, **48**, 81—98).—In order to obtain trustworthy results by the method described by Busch (Abstr., 1905, ii, 282), the solution should contain about 0·1% of nitrate; the nitrate solution under examination should, therefore, be concentrated or diluted until this concentration is attained. Dextrin, gelatin, and possibly other organic compounds hinder the crystallisation of nitron nitrate, but the presence of aluminium sulphate, magnesium sulphate, ammonium sulphate, potassium phosphate, magnesium chloride, tartaric acid, citric acid, sucrose, and dextrose is without influence on the estimation. When oxalic acid is present, the results obtained are too high. Chloric acid precipitates nitron quantitatively as nitron chlorate if the solution contains about 0·25% of chloric acid, but nitric and chloric acids may be estimated together in the same solution if the amount of one of the acids is known. W. P. S.

Detection of Phosphorus. J. Peset (*Zeitsch. anal. Chem.*, 1909, **48**, 35—36).—From the experiments carried out by the author, it is seen that Mitscherlich's process is capable of detecting the presence of as little as 0·0000021 gram of phosphorus, whilst the phosphorescence produced by 0·0000085 gram is very visible. In carrying out the test, it is recommended that the liquid or substance suspected of containing phosphorus should be placed in a flask of about 400 c.c. capacity and connected with a glass tube some 60 cm. long and 6 mm. in diameter. If the contents of the flask are heated to boiling, then cooled slightly, and again boiled, the phosphorescence is more readily seen, not only in the glass tube, but also in the flask. W. P. S.

Detection of Phosphatic Compounds in Cereals. P. Carles (*Ann. Chim. anal.*, 1909, **14**, 57—58).—The substance (flour, bran, etc.) is mixed with its own weight of nitre and a tenth of its weight of sodium hydrogen carbonate, and introduced by degrees into a platinum crucible heated to redness. When cold, the mass is powdered and again heated. The mass is then heated with dilute nitric acid, and should there remain any char, this may be readily burnt. After boiling the acid liquid for half an hour, adding more nitric acid if necessary, the phosphoric acid is present in its normal form, and may be precipitated by magnesium mixture and finally titrated with uranium solution. By means of this method, the results of the analyses will be perfectly concordant. L. DE K.

Colorimetric Estimation of Phosphoric Acid. ISIDORE POUGET and D. CHOUCHAK (*Bull. Soc. chim.*, 1909, [iv], 5, 104—109).—The method depends on the formation of an insoluble precipitate of strychnine phosphomolybdate when a solution containing sodium molybdate, strychnine sulphate, and nitric acid is added to a solution of a phosphate in nitric acid. The opalescent liquids produced in this way show in the colorimeter tints varying from yellow to brown, depending on the intensity of the opalescence. The exact conditions of working and the precautions to be observed in presence of excess of calcium, iron, or arsenic are described in detail in the original.

T. A. H.

Colorimetric Estimation of Phosphates in Solution with Other Salts. CLARENCE ESTES (*J. Amer. Chem. Soc.*, 1909, 31, 247—250).—Veitch (Abstr., 1903, ii, 329) has shown that ammonium salts and certain chlorides affect the colour of phosphomolybdate solutions. It has now been observed that, in estimating phosphorus in meat by the colorimetric method, the salts introduced into the solution with the phosphates from the oxidising agents used interfere very seriously with the intensity of the colour. A study has therefore been made of the influence of several reagents on the coloration. The results of the experiments show that sodium nitrate and probably potassium ethyl sulphate at first decrease the colour in proportion to the quantity of salt present, but that as the amount is increased a certain intensity is reached, beyond which further addition of the salt does not produce any change. Sodium sulphate, potassium hydrogen sulphate, magnesium sulphate, sodium chloride, and an excess of nitric acid all greatly diminish the intensity of the colour, and, if present in large quantities, reduce it to a mere trace. When calcium or magnesium nitrate is added to the solution, the colour is at first reduced, but, on adding a larger quantity, the colour is gradually restored, until it becomes nearly normal. Tables are given which express the percentage error caused by these salts in the colorimetric estimation of phosphates, and also the quantity of each salt which will produce an error of approximately 5% in the readings. E. G.

Volumetric Estimation of Phosphoric Acid, Mono-alkali and Di-alkali Phosphates. JOHN M. WILKIE (*J. Soc. Chem. Ind.*, 1909, 28, 68—69).—The method is based on the fact that when silver nitrate is added to an orthophosphate the precipitate always consists of trisilver phosphate, the precipitation is rendered complete by addition of sodium acetate, and the amount of acetic acid liberated, which, of course, varies according to the nature of the phosphate used (phosphoric acid, mono-sodium hydrogen phosphate, di-sodium hydrogen phosphate) is then titrated with *N*/10 barium hydroxide, using phenolphthalein as indicator. By way of a check, a definite quantity of *N*/10 silver solution having been used, the excess of silver may be titrated by Volhard's method.

If carbonates are present, the silver titration should be applied after expelling the carbon dioxide by means of $N/10$ sulphuric acid.

L. DE K.

Detection of Small Quantities of Arsenic and Preparation of Arsenic-free Chemicals. GEORG LOCKEMANN (*Verh. Ges. deut. Naturforsch. Aertze.*, 1907, ii, 143—145).—The organic matters are destroyed by heating with nitric and sulphuric acids and subsequent fusion with nitre. The neutral or faintly acid solution finally obtained is mixed with a little iron-alum, and enough ammonia is added to completely precipitate the ferric hydroxide, which, in the cold, carries down the arsenic. After half an hour, the precipitate is collected, washed with cold water, and then redissolved in dilute sulphuric acid and tested in the Marsh apparatus. According to the author, iron salts do not retard the reaction.

Sulphuric acid may be freed from arsenic by heating it at 250° and passing a current of hydrogen chloride. Arsenic-free chlorides and nitrates may be obtained by treating their solutions with excess of ferric hydroxide; even ammonia may be thus purified. From the purified chlorides and nitrates, the corresponding arsenic-free acids may then be prepared. L. DE K.

Estimation of Carbon Dioxide in Blood. W. DIBBETT (*Chem. Zentr.*, 1909, i, 49; from *Arbb. Geb. Path. Anat. Bact.*, 1908, 6, 228—235).—A weighed quantity of blood (about 5 c.c.) is mixed in a special apparatus with 10 c.c. of strong oxalic acid solution, and the carbon dioxide evolved is absorbed in standard barium hydroxide solution. When the barium carbonate has subsided, the excess of hydroxide is titrated with standard oxalic acid. L. DE K.

Estimation of Calcium Oxide in Presence of Calcium Carbonate, etc. HEYER (*Chem. Zeit.*, 1909, 33, 102—103).—2·5 Grams of the sample are placed in a half-litre flask with 125 c.c. of water, and, after shaking, 125 c.c. of 2% ammonium chloride solution are added. The stopper is inserted, and the whole well shaken at intervals for some time. Water is then added up to the mark (or a trifle over to compensate for undissolved matter), the whole is again well shaken, and then allowed to subside. An aliquot part is withdrawn and titrated with $N/10$ acid. The ammonia found represents the calcium oxide, for calcium carbonate does not act on ammonium chloride in the cold. L. DE K.

Volumetric Estimation of Barium. ARTHUR E. HILL and WILLIAM A. H. ZINK (*J. Amer. Chem. Soc.*, 1909, 31, 43—49).—A quantity of barium salt containing about 0·1 gram of barium is dissolved in water and rendered faintly alkaline with ammonia. After diluting to 60—70 c.c., $N/6$ potassium iodate is added to the extent of 25 c.c. more than is required theoretically. When, after stirring, the barium iodate has settled, it is collected on a filter and washed three times with strong ammonia and then with alcohol. The precipitate, and afterwards also the filter, is transferred to a flask, 50 c.c. of 10% potassium iodide and 10 c.c. of hydrochloric acid are added, and the iodine liberated is titrated with $N/10$ thiosulphate. One mol. of this = 1/12 at. of barium; sodium salts do not interfere. When potassium or ammonium compounds are present, the barium must be precipitated from a hot solution. In presence of magnesium a little ammonium chloride should be added, and the liquid heated before precipitation. Calcium or strontium should be absent. L. de K.

Estimation of Lead as Oxalate. Wilhelm Böttger [and K. Pollatz] (*Verh. Ges. deut. Naturforsch. Aerzte.*, 1907, ii, 175—177). —The acid solution is neutralised with ammonia, and acetic acid is added so as to get an $N/2$ acid solution. The lead is then precipitated with a slight excess of oxalic acid.

After washing with cold water, the lead oxalate is dried at 100° and weighed, or it may be titrated with permanganate. L. de K.

Electrolytic Estimation of Lead and of Manganese by the Use of the Filtering Crucible. Frank A. Gooch and F. B. Beyer (*Amer. J. Sci.*, 1909, [iv], 27, 59—63; *Zeitsch. anorg. Chem.*, 1909, 61, 286—292. Compare Abstr., 1908, ii, 529).—Good results may be obtained in the case of lead with the filtering crucible as an electrolytic cell if nitric acid is present in the proportion of 30 c.c. of the strong acid in 100 c.c. of the solution. The liquid should be kept in continuous filtration until the lead has completely deposited as peroxide, and the acid liquid must then be displaced gradually by solution of ammonium nitrate, and all the while the current must be kept up. After washing with water, the peroxide is dried at 200° and weighed.

Manganese is deposited from a solution containing free sulphuric acid as hydrated peroxide, which is then converted into the anhydrous condition by cautious heating, first at 200°, and then in the spreading flame of a large burner. L. de K.

Analysis of Red Lead. Alfred Partheil (*Verh. Ges. deut. Naturforsch. Aerzte.*, 1907, ii, 159).—The estimation of the insoluble constituents of red lead by the extraction of the latter with hot nitric and oxalic acids is inaccurate, since the resulting solution of lead nitrate yields a sparingly soluble precipitate of oxalate and oxalonitrate of lead. Good results are obtained by treating the red lead (2·5 grams) with 10 c.c. of water, 5 c.c. of lactic acid, and 10 c.c. of 25% nitric acid; the insoluble portion is washed, dried, and weighed.

The value of a technical red lead can be determined by its colour, or by an estimation of the lead peroxide by Topf's method (Abstr., 1887, 997).

Of the samples examined, only a few approximated to the composition Pb_3O_4; several gave values approaching Pb_4O_5. C. S.

Action of Permanganate on Ferrous Salts in Presence of Hydrochloric Acid. W. Colet Birch (*Chem. News*, 1909, 99, 61—63, 73—74).—Fresenius' method of titrating iron with permanganate in presence of hydrochloric acid by adding an equal amount of the ferrous solution after the first titration and re-titrating, this process being repeated several times, is inaccurate. The addition of various salts, recommended by several authors, is usually without effect, ammonium sulphate even making the results less accurate. Manganese sulphate gives fairly good results, preventing chlorine from escaping, but is troublesome (compare Harrison and Perkin, Abstr., 1908, ii, 228).

The brown compound, which obscures the end-point, is $MnCl_3$, as is shown by its isolation as $MnCl_3,2KCl,H_2O$. C. H. D.

Precipitation of Cobalt by Potassium Nitrite. Lucien L. de Koninck (*Bull. Soc. chim. Belg.*, 1909, 23, 11—13).—The author states that cobalt is effectually precipitated by adding to the solution, which should contain free nitric acid, a solution of potassium nitrite far more than sufficient to neutralise the acid. The precipitation is then more complete than when working, as usual, in a solution containing free acetic acid. Traces of cobalt, often present in commercial nickel salts, may thus be isolated. L. de K.

Procedure for the Oxidation of Chromic Acid to Perchromic Acid. William J. Karslake (*J. Amer. Chem. Soc.*, 1909, 31, 250—251).—In the detection of chromium by the oxidation of chromic acid to perchromic acid, it is usual to acidify the solution, then to add ether, and finally a little hydrogen peroxide. When this procedure is followed, it often happens that the reduction of the perchromic acid to a chromium salt is so rapid that the blue colour is not produced. If, however, the hydrogen peroxide is added first and thoroughly mixed with the neutral or alkaline chromate solution, and the mixture is then treated with dilute sulphuric or nitric acid, a good blue coloration is produced, even in the absence of ether. The addition of ether is not necessary, except for the detection of traces of chromium. E. G.

Iodometric Estimation of Vanadic Acid, Chromic Acid, and Iron Oxide in the Presence of One Another. Graham Edgar (*Amer. J. Sci.*, 1909, [iv], 27, 174—178; *Zeitsch. anorg. Chem.*, 1909, 61, 280—285).—A process for the estimation of vanadic and chromic acids in presence of each other, and based on the differential reducing action of hydrobromic and hydriodic acids, has been described previously (Abstr., 1908, ii, 989). The author now states that this is also available in presence of ferric iron, which is also reduced by boiling with hydriodic acid.

In order to obtain the necessary data for calculation, it is necessary to determine one of the constituents separately; the author prefers estimating the chromic acid in a portion of the original solution as follows. A slight excess of sulphuric acid and a few c.c. of syrupy phosphoric acid are added, and then an excess of standard arsenious acid. After about twenty minutes, the solution is made alkaline with sodium hydrogen carbonate, and the excess of arsenious acid is titrated by adding excess of standard iodine and titrating this, after the lapse of half an hour, with standard thiosulphate, using starch as indicator. L. de K.

Volumetric Estimation of Bismuth. RICHARD EHRENFELD and A. INDRA (*Zeitsch. anal. Chem.*, 1909, 48, 24—26).—The phosphate method for the volumetric estimation of bismuth (Abstr., 1908, ii, 72) yields trustworthy results if the cochineal indicator, described by Repiton (Abstr., 1908, ii, 320), is employed in the final titration. Results of experiments are recorded which show that the average error of the process amounts to 0·6% of the bismuth present, which is less than the error observed in the process as described originally.

W. P. S.

Elementary Analysis of Organic Substances. KENZŌ SUTŌ (*Zeitsch. anal. Chem.*, 1909, 48, 1—17).—Several modifications of the apparatus usually employed are suggested. A drying tube is inserted between the air or oxygen purifying tubes and the combustion tube in order to prevent any moisture yielded by the indiarubber connexions finding its way into the weighed calcium chloride tube. The outlet end of the combustion tube is surrounded by a small steam-jacket, so that the water resulting from the combustion cannot collect at the end of the tube, and this end may be connected directly with the calcium chloride tube by means of a glass adapter fitting closely to the end of the combustion tube. The joint is rendered air-tight by means of a piece of rubber tubing. W. P. S.

Combustion of Compounds Containing Nitrogen by the Simplified Method. MAX DENNSTEDT and F. HASSLER (*Chem. Zeit.*, 1909, 33, 133).—The lead peroxide used in the authors' simplified process should be mixed with half its bulk of pure red lead in order to absorb the nitric fumes given off in the combustion, which otherwise would affect the carbon and hydrogen determination.

L. DE K.

New Potash Apparatus. M. S. LOSANITSCH (*Ber.*, 1909, 42, 237).—The apparatus is a modification of the Geissler bulb. The gas passes first into a glass vessel, in which are three small wash-bottles in series, all being half full of potassium hydroxide. It is thus exposed to a considerable surface of the absorbent before passing into the wash-bottles. A drying tube of the usual pattern is fused to the glass vessel. The apparatus weighs about 25 grams empty and 50—60 grams when filled. E. F. A.

Estimation of Carbon by means of the Bomb Calorimeter. J. AUGUST FRIES (*J. Amer. Chem. Soc.*, 1909, 31, 272—278).—A modification of the bomb calorimeter is described, which is recommended for determining both the heat of combustion and the carbon content on the same material, or can also be used for the estimation of carbon alone. The top of the calorimeter is provided with two openings and valves, an inlet terminating on the inside of the cover, and an outlet extending by means of a fine platinum tube to within about ⅜-inch of the bottom of the bomb. After ignition, the gas in the bomb is led by means of an aspirator through four U-tubes, of which the first and last contain pumice stone and sulphuric acid, whilst the other two contain soda-lime, to absorb the carbon dioxide. Results of carbon estimations by means of this apparatus are quoted, and show that the method is trustworthy and accurate.

It is suggested that hydrogen could also be estimated with the bomb calorimeter, but for this purpose the bomb would have to be lined with platinum or other non-corroding material, as otherwise the escaping acids would attack the apparatus. E. G.

Estimation of Essential Oils. MARTIN KLASSERT (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 131—132).—It is pointed out that during the evaporation of the ethereal solution of the essential oil, obtained as described by Reich (Abstr., 1908, ii, 1075), moisture may condense on the ethereal solution, and also that ether itself contains water; consequently, the residue of essential oil in many cases contains small quantities of water. The author recommends that the evaporation of the ether should be carried out in a basin, which is placed under a bell-jar. A current of dry air is drawn in at the top of the bell-jar by means of a water pump attached to a tube passing through a tubulure near the bottom of the side of the jar; this tube is bent inside the bell-jar so that its end is just above the surface of the solution contained in the basin. The air current is regulated to about 60 bubbles per minute, a drying bottle being placed between the tube and the pump for this purpose, and when the ether has been evaporated, the opening at the top of the bell-jar is closed while the pump is kept working. The reduced pressure thus produced in the bell-jar causes any condensed water to evaporate quickly, and the essential oil remaining in the basin is then weighed, after the basin and its contents have been allowed to attain the ordinary temperature. During the evaporation of the ether, the temperature is so reduced that there is but little, if any, loss of essential oil. W. P. S.

Precipitation of Reducing Sugars with Basic Lead Acetate. A. HUGH BRYAN (*Zeitsch. Ver. deut. Zuckerind.*, 1909, 1—4. Compare Pellet, Abstr., 1906, ii, 400; Watts and Tempany, Abstr., 1908, ii, 236; and Prinsen-Geerligs, Abstr., 1908, ii, 991).—To determine the effect of various clarifying agents (lead salts) on reducing sugars, solutions of dextrose and lævulose were prepared containing 5 grams of the sugar and 1 gram each of magnesium sulphate and ammonium tartrate; the lead salt was added to 50 c.c. of the solution, and the whole diluted to a volume of 100 c.c. After filtration, the excess of lead was removed by means of potassium oxalate, and the sugar estimated by Allihn's method. The results obtained show that normal lead acetate precipitated practically no sugar, but that basic lead acetate, whether added as a solution or in the dry state, and basic lead nitrate removed very large amounts of sugar; in every case more lævulose was precipitated than dextrose. It was also found that the polarisation of mixed solutions of sucrose, dextrose, and lævulose was affected by clarification with lead salts in the presence of optically inactive substances precipitable by lead, a portion of the reducing sugars being removed by the precipitate formed. W. P. S.

A Method to Show the Presence of Pentoses in the Presence of Ketoses. HERBERT E. ROAF (*Proc. physiol. Soc.*, 1908, v; *J. Physiol.*, 38).—If ketoses are present, the reaction of pentoses with phloroglucinol or orcinol and hydrochloric acid is obscured by the occurrence of a brown precipitate. But if the solution is distilled with 6% hydrochloric acid, the distillate gives characteristic reactions; phloroglucinol and hydrochloric acid give first a brown and then a dark green colour, or if orcinol is used, there is first a grey and then a bluish-green. These results are not masked by the presence of ketoses. W. D. H.

Seliwanoff's Test for Sugars of the Lævulose Group. JOSEPH PIERAERTS (*Bull. Assoc. chim. sucr. dist.*, 1909, 26, 560—562 [*]).—The author states that Seliwanoff's reagent (resorcinol and hydrochloric acid) does not afford a ready means for the recognition of lævulose and its anhydrides in sugar mixtures. L. DE K.

Apparatus for Reversed Filtration and its Application to the Estimation of Fibre. WATZLAFF IWANOWSKY (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1753—1756).—The disadvantages of the various apparatus which have been described for reversed filtration, such as that of Blümmer (*Chem. Zeit.*, 1908, 32, 232), lie in the limited choice of filtering material, which must be paper or fine cloth, and in the readiness with which the filter, when of paper, tears.

The apparatus devised by the author to remove these disadvantages consists of a tube widened at one end, into which fit two perforated disks of glass, porcelain, etc., holding between them the filtering material, and retained in position by means of a rubber band. The tube is immersed in the solution to be filtered and connected with an exhausted flask.

The estimation of fibre in food materials can be readily carried out by means of the apparatus. The material is boiled with dilute sulphuric acid, which is then sucked through the filter fitted with a cloth disk, and the residue washed twice with water, the latter being sucked off in each case; "dickes Crême-Tuch" is the best material for the filter. The cloth filter and the residue are then boiled together with dilute alkali, which dissolves the cloth quantitatively. One quantitative filter and four disks of quick-filtering paper having been previously dried and weighed, the alkaline liquid, cooled to 40—30°, is drawn off through the filter fitted with one of the quick-filtering papers. The residue is boiled with water, which is sucked through another of the papers. Finally, the residue and the two used papers are boiled with water, and the whole filtered through the two remaining filters, which are then washed, dried, and weighed. This method is found to give accurate results. T. H. P.

Colour Reactions of Dihydroxyacetone. GEORGES DENIGÈS (*Compt. rend.*, 1909, 148, 172—173).—In presence of concentrated sulphuric acid, dihydroxyacetone develops intense and permanent colorations when added to phenols or to certain opium alkaloids. 0·1 c.c. of a solution of the phenol or alkaloid (1 gram + 28 c.c.

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[*] and *Bull. Soc. chim.*, 1909, [iv], 5, 248—250.

alcohol, 90—95%) is mixed with 0·4 c.c. of a solution of dihydroxyacetone containing not more than 1 gram per litre; exactly 2 c.c. of sulphuric acid (D 1·84) are then added, and the coloration appears in one or two minutes. Codeine gives a blue tint even with 0·0001 mg. of dihydroxyacetone.

Morphine and heroine give violet or sepia tints, whilst thymol gives a blood-red, and β-naphthol a green, coloration, the solution in the latter case showing a green fluorescence. Resorcinol gives a colour resembling that of the alkali dichromates. W. O. W.

New Reactions of Dihydroxyacetone. Georges Denigès (*Compt. rend.*, 1909, 148, 282—283. Compare preceding abstract).—The reactions previously ascribed by the author to dihydroxyacetone are not specially characteristic of the pure compound, but are partly due to the presence of bromine. To obtain the reactions with pure dihydroxyacetone, it is necessary to add 0·1 c.c. of a 4% solution of potassium bromide to the other reagents employed. Under these conditions, guaiacol gives a blue coloration, salicylic acid a raspberry-red, and gallic acid a deep violet coloration. W. O. W.

Detection of Benzoic and Salicylic Acids in Fermented Beverages and in Milks. Lucien Robin (*Ann. Chim. anal.*, 1909, 14, 53—54).—*Wines, Ciders, Beers.*—Fifty c.c. of the liquid are mixed with a little ferric chloride and a little hydrochloric or sulphuric acid, and shaken with 40—50 c.c. of ether. After washing the ether twice, one-half is taken and used for the detection of salicylic acid; the other portion is shaken with 25 c.c. of a weak alcoholic solution of sodium hydrogen carbonate, and the alkaline liquid is evaporated to dryness and examined for benzoic acid by the nitration test described previously (Abstr., 1908, ii, 1078).

Milk.—This must be deprived first of its fatty matter and casein. Fifty c.c. of the sample are slowly added with stirring to a mixture of 10 c.c. of 5% sulphuric acid and 20 c.c. of strong alcohol, and the filtrate, which must be quite clear, is then treated with ether as directed. If an emulsion forms, some more water may be added, and the ether should be washed with water containing a very little alcohol. L. de K.

Microscopical Detection of Lichen Acids. Emanuel Senft (*Verh. Ges. deut. Naturforsch. Aertze.*, 1907, ii, 161—164).—A particle of the thallus is put on an object glass and covered with a large drop of bone oil. After breaking it up with a lancet as much as possible, a thick covering glass is placed on it, but by means of a second covering glass, or a thin strip of paper, it is raised slightly at one side.

The glass is now heated over a small flame for some time to extract the acids, and the cover is then gently pressed with a lead pencil and moved so as to collect the liquid on one spot. After the lapse of about one day, the slide is examined under the microscope. Sometimes it is advisable to extract a larger quantity of the lichens with a suitable solvent (chloroform, benzene, alcohol, etc.), and to recrystallise the residue left on evaporation from bone oil as directed.

In this manner, the author has obtained characteristic crystals of *calycin*, *chrysocetraric acid*, *pinastric acid*, *oxypulvic acid*, *rhizocarpic acid*, *vulpic acid*, *methylpulvic acid*, *callopismic acid*, *physcianin*, and *parietin*. L. de K.

Characterisation of Fish Oils by the Bromine Addition Products. Henrik Bull and J. C. F. Johannesen (*Chem. Zeit.*, 1909, 33, 73—74).—A modification of Hehner and Mitchell's gravimetric method so as to render it suitable for the testing of dorse liver oil. One gram of the fatty acids obtained from the sample is dissolved in 5 c.c. of glacial acetic acid and 25 c.c. of ether, and 0·5 c.c. of bromine is added very slowly with continual cooling and shaking.

The precipitate is collected in a weighed tube containing asbestos, washed thrice in succession with 5 c.c. of the ether-acid mixture, and then twice with 5 c.c. of dry ether. The tube is then dried at 100° and weighed. Genuine dorse liver oil yields about 34% of brominated product, but on altering the proportions of the reagents, or on adding the bromine carelessly, quite different figures are obtained.

L. de K.

Detection of Aniline. J. Peset (*Zeitsch. anal. Chem.*, 1909, 48, 37—40).—Several characteristic colour reactions produced by the action of oxidising agents on aniline are given. If two drops of aniline are treated with 0·5 c.c. of concentrated nitric acid and 0·2 gram of potassium chlorate, a blue coloration is produced, which quickly changes to yellowish-red; after a short time, an odour of benzaldehyde is noticed, and a gas is evolved containing hydrogen cyanide. On diluting the mixture with water, a yellow precipitate forms, which is insoluble in benzene, light petroleum, and chloroform, but soluble in amyl alcohol and acids. The blue solution and the amyl alcohol solution exhibit absorption spectra. If the aniline solution tested is dilute, heat must be applied in order to obtain the colorations. One part of aniline in 102,400 parts of water shows a feeble yellow coloration; if ammonia is added and the mixture shaken with amyl alcohol, 0·000009 gram of aniline may be detected. Concentrated nitric acid and sodium hypochlorite give a blue coloration with aniline; the colour changes to red, and becomes brown on the addition of ammonia. Both colours are soluble in amyl alcohol. Nitric acid and sodium nitrite, manganese dioxide or lead peroxide, give a green coloration with aniline, changing to red, whilst nitric acid and potassium dichromate yield an intense red colour, which gradually becomes green, then blue, and finally red with the evolution of gas. If permanganate is employed with nitric acid, a green coloration changing to blue is observed. When aniline is treated with 10% acetic acid and sodium peroxide, a yellow coloration is obtained on boiling the solution. All these colours are soluble in amyl alcohol in the presence of ammonia, and the solutions show absorption bands. W. P. S.

Detection of Methylaniline and Dimethylaniline in Presence of Each Other. Hermann Emde (*Arch. Pharm.*, 1909, 247, 77—79). —Several grams of the substance under examination are dissolved in strong hydrochloric acid, and the solution added drop by drop to excess of platinum tetrachloride dissolved in water. By careful crystallisation of the precipitate from alcohol containing hydrogen chloride, the two platinichlorides can be separated. Methylaniline platinichloride, m. p. 199° (decomp.), forms compact, orange-red crystals. *Dimethylaniline platinichloride*, m. p. 173° (decomp.), crystallises in orange-red needles, and decomposes when warmed in water, forming an inky fluid. Instead of separating the two platinichlorides, the original precipitate may be boiled with water, when, if dimethylaniline platinichloride is present, an inky liquid is formed. From this, methylaniline platinichloride crystallises out on cooling.

T. A. H.

Estimation of Urea. F. Haesler (*Chem. Zeit.*, 1909, **33**, 110).—The urine, representing not more than 0·1 gram of urea, is added slowly from a burette to 25 c.c. of sodium hypobromite solution (200 grams of sodium hydroxide free from carbonate in 750 c.c. of water; when cold, 50 c.c. of bromine, and then water up to a litre), and the carbon dioxide formed in the reaction is estimated gravimetrically in Henriques and Meyer's apparatus (Abstr., 1900, ii, 687). Before liberating the carbon dioxide, it is necessary to reduce the excess of hypobromite, and this is done effectually by means of zinc or aluminium powder. The reduction is carried out in a flask furnished with a Bunsen valve, so as to exclude atmospheric carbon dioxide, and is complete after three hours. A blank experiment should be made once for all to determine any carbon dioxide present in the hypobromite itself. Carbon dioxide × 15/11 = urea. L. de K.

Estimation of Urea. Adolf Jolles (*Zeitsch. anal. Chem.*, 1909, **48**, 26—30).—In the process described, the urea is decomposed by alkaline sodium hypobromite, the excess of hypobromite decomposed by nascent hydrogen, and the carbon dioxide, resulting from the decomposition of the urea, is then liberated by the addition of acid, collected, and weighed. The urea solution, containing not more than 0·25 gram of urea, is placed in a flask, and 100 c.c. of sodium hypobromite solution (prepared by dissolving 30 grams of bromine in 500 c.c. of 10% sodium hydroxide solution) are added. The flask is closed by a Bunsen valve, and the contents are shaken for five minutes. Three grams of Devarda's mixture (45 parts of aluminium, 50 parts of copper, and 5 parts of zinc) are then added, and, after two hours, the flask is connected with an upright condenser, the upper end of which is connected in turn with drying tubes and a weighed potash bulb. A current of air free from carbon dioxide is drawn through the whole apparatus, and hydrochloric acid is added gradually through a tapped funnel to the contents of the flask. The latter is eventually heated, and the current of air continued until the whole of the carbon dioxide has been absorbed in the potash bulb. The increase of weight of the latter is a measure of the urea, as 44 parts of carbon dioxide are equivalent to 60 parts of urea. A blank estimation is necessary, in order to allow for the carbon dioxide which is invariably present in the reagents employed. The method yields trustworthy results in the case of pure urea. W. P. S.

A New Ureometer. M. Emmanuel Pozzi-Escot (*Ann. Chim. anal.*, 1909, **14**, 52—53).—The decomposition flask containing 1 or 2 c.c. of the urine is fitted with a cylindrical reservoir filled with the hypobromite solution. By gently turning a stopcock, a desired volume of the reagent is made to flow into the urine. The nitrogen evolved escapes through a side-tube, and is collected over water and measured with the usual precautions. L. de K.

Estimation of Alkaloids in Coca Leaves. Anne W. K. de Jong (*Rec. trav. Chim.*, 1908, **27**, 419—421).—12·5 Grams of the finely-powdered leaves, moistened with 5 c.c. of 25% ammonia, are extracted in a Soxhlet apparatus with light petroleum of low b. p. After ten to fifteen hours' extraction, the petroleum is poured into a separating funnel, and, after rinsing the flask with some light petroleum, the leaves are extracted a second time for three hours. The mixed petroleum extracts are then shaken, first with 50 c.c. and then 25 c.c. of 0·5% hydrogen chloride solution. The acid extracts are passed through a small filter, which is then washed twice with water. The filtrate is shaken once with ethyl ether, which is rejected, and the liquid is then rendered alkaline with ammonia and shaken, first with 50 c.c. and then with 25 c.c. of ether. The ethereal solution is then introduced into a flask, and when it has become quite clear, it is carefully decanted into a weighed flask, and the other flask is rinsed twice with a little ether. The ether is then recovered by distillation, and the last traces are removed by placing the flask in boiling water and passing a current of air. After cooling in a desiccator, the flask is re-weighed. L. de K.

Estimation of Creatinine in Urine. G. Edlefsen (*Chem. Zentr.*, 1909, i, 108; from *Münch. med. Woch.*, 1908, **55**, 2524—2527).—The creatinine is precipitated by means of dilute sulphuric acid in presence of alcohol and ether; the precipitate is collected and redissolved in water, and then titrated with barium hydroxide with phenolphthalein as indicator; 0·396 SO_4 = 0·604 creatinine. The urine should be first freed from phosphates and sulphates by the usual barium mixture. According to another process, after removing urea with mercuric nitrate, 10 c.c. of the urine are mixed with 5 c.c. of a 1% solution of salicylic acid, and the excess of this is extracted by shaking with pure ether and titrated with *N*/2 sodium hydroxide. Twenty-two parts of salicylic acid combine with seventy-eight parts of creatinine. L. de K.

Estimation of Tannins. Luigi Ermanno Cavazza (*Chem. Zentr.*, 1908, ii, 2045; from pamphlet, 4 pp.).—The tannin solution is precipitated with calcium hydroxide solution, and the calcium tannate is introduced into a narrow tube graduated for the purpose. After settling, the volume is read off, and this calculated into the corresponding weight of tannin. L. de K.

General and Physical Chemistry.

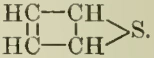
New Proof of the Existence of Molecules. The Svedberg (*Zeitsch. physikal. Chem.*, 1909, 65, 624—633).—The absorption of light in solutions is proportional to the concentration, c, of the solute and to the length, l, of the absorbing layer. In the present paper the limiting value of the absorption constant, $\lim.k = cl$, has been determined by measurements under such conditions that the absorption is just visible.

The apparatus consists of two tubes of Jena glass, A and B, each two metres long and 15 mm. in diameter, placed parallel to one another and illuminated at one end by a flame and screen. The tube A contains distilled water, and B the solution to be tested; in front of A is placed a glass trough with parallel sides, containing a known volume of distilled water. From a burette a concentrated solution of the substance contained in B is dropped into the distilled water in the trough until the colours of the two tubes appear the same. It is shown by experiments with copper sulphate and with magenta that $\lim.k$ can be determined with considerable accuracy in very dilute solution; in the case of magenta, at a dilution of 1×10^{-7} normal.

The method has been used to investigate the solutions of colloidal gold obtained by reduction with hydrazine hydrochloride and with an ethereal solution of phosphorus respectively. The concentration of the gold solution was varied, and in each case the value of $\lim.k$ was determined, and, when practicable, the size and number of the colloidal particles determined by means of the ultramicroscope. The results show that the particles become progressively smaller the greater the dilution. The curve obtained by plotting the values of $\log(1/\lim.k)$ as ordinates against the values of $\log(1/\text{concentration})$ rises at first, attains a maximum, and then falls continuously as far as the observations can be carried. The observations show that the specific absorption in the colloidal region is at first nearly independent of the concentration, but in less concentrated solution decreases rapidly. As the fall in absorption runs parallel with a diminution in the size of the particles, as far as the latter can be observed with the ultramicroscope, it may be assumed that the steady diminution of the absorption in still more dilute solution indicates a further diminution in the size of the particles in regions inaccessible to the ultramicroscope. G. S.

Importance of Refractometric Investigations in Pharmacy. Endre von Kazay (*Chem. Zentr.*, 1909, i, 309; from *Pharm. Post*, 1908, 41, 993—994).—Examples are given which show the importance of determining the molecular refraction of substances as a means of ascertaining the nature of their internal structure. With pyridine it is experimentally found that $n_D = 1{\cdot}50468$, D 0·979, hence $M(n-1)/D = 40{\cdot}7$; thus supporting the structure assigned by Reidl and Dewar (which gives a calculated value 40·0).

When extended to the consideration of two rings, similar accord is

observed between the observed and the calculated values for molecular refraction, thus: Naphthalene, $n_D = 1·5245$, D 0·962 (98°), $M(n-1)/D = 76·45$ (calc. 76·4). β-Naphthol, $n_D = 1·6114$, D 1·1 (99°), $M(n-1)/D = 79·2$ (calc. 79·2); also with quinoline the Reidl-Dewar structure is valid, $n_D = 1·6093$, D 1·0947, $M(n-1)/D = 71·78$ (calc. 71·8). The refractive index found for thiophen from $n_D = 1·5237$, D 1·0643, $M(n-1)/D = 41·32$, is in agreement with the structure 
$\begin{matrix} HC-CH \\ \| \quad | \\ HC-CH \end{matrix}\!>\!S$.
The fact of being able to differentiate between molecular structures by molecular-refraction measurements makes it possible to decide whether an artificially prepared substance is identical in all respects with the natural substance. For instance, the refractive index of artificial camphor is $(n-1)/a = 0·4873$, whilst that of natural camphor is 0·5036, showing that the more highly refractive natural substance contains a double linking in the ring, $M(n-1)/a = 76·54$ (calc. 76·6).

J. V. E.

Resolution of Racemic Substances Prepared by Chemical Synthesis. Effect of Circularly-polarised Light.

A. Cotton (*J. Chim. Phys.*, 1909, 7, 81—96. Compare Cotton, *Ann. Chim. Phys.*, 1896, [vii], 8, 373; Byk, Abstr., 1905, ii, 70).—The author discusses the possibility of resolving a racemic mixture into its components by physical means, and draws the conclusion, in agreement with P. Curie, that the resultant of the physical agents employed must also possess enantiomorphous dissymmetry, and must influence the chemical change in a definite way. These requirements should be satisfied by circularly-polarised light.

Experiments are described in which an alkaline solution of copper racemate was exposed in vessels for several days to solar light circularly polarised to right and left respectively. The conditions in this case appear particularly favourable to resolution, because the *d*- and *l*-tartrates absorb right and left rays unequally, and the solutions undergo reduction on exposure to light. The solutions, however, showed no optical activity at the end of the experiment. Among other causes of this failure it is suggested that the solutions may have been too concentrated, and therefore the salt was not sufficiently split up into its *d*- and *l*-components.

The possible mode of formation of optically active substances in nature is briefly discussed.

G. S.

Formation of [Optically] Active Compounds by P. Curie's Method.

Philippe A. Guye and G. Drouginine (*J. Chim. Phys.*, 1909, 7, 97—100. Compare Curie, *J. Phys.*, 1894, [iii], 3, 641; Cotton, preceding abstract).—Curie has suggested that the formation of one of the optical antipodes ought to be favoured if the chemical change which ordinarily gives rise to a racemic mixture is carried out in a dissymmetric medium constituted by the superposition of a magnetic or an electrostatic field. In order to test this theory, the authors have examined the reaction in which bromine combines with methyl fumarate to form methyl dibromosuccinate, and the analogous reaction in which bromine combines with methyl cinnamate, but the products showed no sign of optical activity.

The investigation is being continued with more powerful fields.

G. S.

Dispersion of Light in Gases. I. Dispersion of Acetylene and Methane. Stanislas Loria (*Bull. Acad. Sci. Cracow*, 1908, **10**, 1059—1067).—The refractive indices of methane and acetylene have been measured for a series of wave-lengths by the interferometer method. The methane was prepared from magnesium methyl iodide, and the acetylene from calcium carbide, the primary product being purified by fractional distillation. The values of a and b in the dispersion formula $n-1=a(1+b/\lambda^2)$ are for methane: $a=0{\cdot}00042607$, $b=1{\cdot}441\times10^{-10}$, and for acetylene, $a=0{\cdot}00054242$, $b=1{\cdot}453\times10^{-10}$.

H. M. D.

A New Bunsen Spectroscope for the Investigation of Absorption Spectra of Liquids. Otto Schumm (*Zeitsch. physiol. Chem.*, 1909, **59**, 54—56).—The instrument which is described in full, with diagrams, gives sharp results.

W. D. H.

Connexion between Band and Line Spectra of the same Metallic Elements. W. Noel Hartley (*Sci. Trans. Roy. Dubl. Soc.*, 1908, ii, **9**, 85—138).—Experiments have been made to ascertain the connexion between the bands and lines which characterise the spectra of certain elements. Calcium spectra were obtained from (1) solid calcium salts ignited in the oxyhydrogen flame, (2) metallic calcium in the flame of a Mecke burner, (3) lime in the same flame, (4) the condensed spark between electrodes of metallic calcium, and (5) the spark, without condenser, taken from solutions. The flame spectra of the elements rubidium, cæsium, calcium, strontium, barium, silver, copper, tin, lead, and thallium were obtained when gradually diminishing quantities of salts of the metals were introduced into the oxyhydrogen flame. The quantities were varied by dropping determinate volumes of solutions of known strength on to ashless filter papers, which were then dried and introduced into the flame. The observations lead the author to the conclusion that the banded flame spectra are the spectra of the atoms, and that the monatomic metallic elements, which exhibit two spectra, one of lines and the other of bands, can exist in two different conditions, the difference being due to the larger amount of energy associated with the atom which exhibits a line spectrum. The acquisition of energy by the primitive or normal atom arises from its chemical properties and from the excess of energy, which is transferred to it in the flame or arc, over that which is necessary to liberate the atom from its compounds.

H. M. D.

Spectroscopic Investigation of the Behaviour of Metallic Salts in Flames of Different Temperatures. Herbert Auerbach (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, **7**, 41—66).—The apparatus used in the experiments was described in the first part of the paper (this vol., ii, 105). The author records the spectral lines and bands which were obtained when the alkali and alkaline earth metals, copper, manganese, iron, nickel, and cobalt in the form of chlorides and thallium and lead in the form of nitrates were introduced into (1) the Bunsen flame, (2) the coal-gas air blow-pipe flame, and (3) the coal-gas oxygen blow-pipe flame. Except in the case of manganese, iron, nickel, and cobalt, all the spectra show an increase in the number of lines and bands as the temperature rises. The increase takes place for the most part towards the ultra-violet end. This indicates that rise of temperature causes a displacement of the energy of emission towards the ultra-violet end of the spectrum. The photographs show lines in the ultra-violet down to $\lambda = 2380$; this result is contradictory to the statement made by Eder and Valenta that flame spectra do not give rise to lines of smaller wave-length than $\lambda = 3000$.

In the third section of the paper the various theories of spectral emission are discussed, and an explanation of the abnormal behaviour of manganese, iron, cobalt, and nickel is given. The chlorides of these metals are volatile in the Bunsen flame, and give rise to spectra without undergoing chemical change. In the coal-gas air blow-pipe flame they are transformed into oxides, which are not sufficiently volatile at this temperature to give rise to emission spectra. In the coal-gas oxygen blow-pipe flame, on the other hand, the oxides are volatile and emission spectra are observed, which, however, differ somewhat from the Bunsen flame spectra. H. M. D.

Normal Lines from the Arc Spectrum of Iron in the Definite System of Rowland. JOHANNES HARTMANN (*Physikal. Zeitsch.*, 1909, 10, 121—124).—A plea for the retention of Rowland's system as the basis of wave-length measurements of spectral lines. Although the absolute value given by Rowland for the standard red line of cadmium has been shown by recent measurements to be inexact, it is maintained that this is not sufficient to warrant a change in the basis of the vast collection of wave-length data. The author has recalculated the data recently obtained by Buisson, Fabry and Perot, Eversheim and Pfund, and these are recorded in the definite Rowland system for which the red cadmium line has the value $\lambda = 6438 \cdot 7098$.

H. M. D.

Dissymmetrical Separations in the Zeeman Effect in Tungsten and Molybdenum. ROBERT JACK (*Proc. Roy. Soc. Edin.*, 1909, 29, 75—83).—The spark spectra of salts of the metals in question were used, and the light of the spark was focussed on the slit of the grating apparatus by means of a quartz lens. The wave-length, distance from middle component, and intensity of many lines are quoted, and it is shown that cases both of normal and abnormal asymmetry occur, that is, the middle component of the triplet may be nearer the component towards the red or violet end of the spectrum respectively. It appears that there is some connexion between the rotation of the plane of polarisation produced by the quartz and the type of dissymmetry, but this rule does not hold in all cases.

The theory of the subject has been developed by Voigt on the assumption that besides coupling between electrons of the same vibration frequency, couplings between electrons of different frequencies may also occur. G. S.

Radiation of Various Spectral Lines of Neon, Helium, and Sodium in a Magnetic Field. John E. Purvis (*Proc. Camb. Phil. Soc.*, 1909, **15**, 45—52).—Measurements have been made of the constituents of various spectral lines of neon, helium, and sodium, using a Rowland grating and field strengths of 24000 and 26100 units. The author finds far fewer constituents than were obtained by Lohmann, who used an echelon of 32 plates and a field of 11000 units, and, in connexion with this, points out the great difficulty in distinguishing the real constituents of a divided line from those of the adjacent images of other orders when an echelon grating is used for the observations. The distances between the constituents of several triplets and the sextriplet ($\lambda = 6383$) are recorded. The shifts of the constituents of various neon lines towards the red end of the spectrum under the influence of the magnetic field have also been measured; the amounts of the shifts are different for different lines. The intensities of the unaltered lines were found to be less than those of the strongest constituents when the neon was subjected to the action of the magnetic field. H. M. D.

Question in Absorption Spectroscopy. Robert A. Houston and Alexander S. Russell (*Proc. Roy. Soc. Edin.*, 1909, **29**, 68—74).—The question whether on mixing two coloured solutions which do not act on one another chemically the absorption spectrum of the components remains unchanged has been investigated. The measurements were made with a special form of spectrophotometer, provided with two slits, one vertically above the other, and the instrument could also be used as a spectroscope. The arrangement was such that the absorption effect when the light passed through the two solutions in succession could be compared with that observed when it passed through the mixed solutions.

For certain salt solutions no effect was observed, but in the case of mixtures of uranyl nitrate with copper sulphate and with nickel sulphate a shifting of certain bands on mixing is observed, and it is shown that this is due to chemical action. There appears to be a slight shifting when a solution of copper sulphate is mixed with an ammoniacal solution of carmine, but there is no evidence as to whether it is physical or chemical. Formánek (*Zeitsch. Farb. Text. Chem.*, 1902, **1**, 505) has stated that on mixing solutions of certain dyes there is a displacement of certain bands, but the authors find by the spectroscopic method no displacement or any alteration of intensity in four of the cases investigated by Formánek. No well-defined case of a physical action between molecules has therefore been observed. G. S.

Selective Reflection and Molecular Weight of Minerals. W. W. Coblentz (*Jahrb. Radioaktiv. Elektronik*, 1907, **4**, 132—136). —As a result of the examination of the absorption and reflection spectra of the sulphates and carbonates of magnesium, calcium, strontium, barium, and lead, it has been found that the maxima of the characteristic bands are displaced towards the red end of the spectrum as the atomic weight of the metallic element increases. When the maxima of the bands are plotted as a function of the atomic weight, the points corresponding with the metals in the above series lie approximately in a straight line. H. M. D.

Decline of Low-temperature Phosphorescence. Joseph de Kowalski (*Compt. rend.*, 1909, 148, 280—282).—The phosphorescence exhibited by certain organic compounds which have been subjected to a strong light at the temperature of liquid air quickly dies out on removing the source of illumination. In the case of the alcoholic solutions of benzene and its derivatives which the author has examined, the phosphorescence extends in an unbroken spectrum from the violet end more or less towards the red, except in the case of coloured substances, which exhibit the usual absorption bands. On removing the source of light, the longer wave-lengths of the phosphorescence spectrum decay much more quickly than the shorter wave-lengths. Thus, in the case of alcoholic aniline, orange persisted three seconds, green twenty-seven seconds, and violet fifty seconds. It is possible that a particular wave-length in the ultra-violet would exhibit a maximum of persistence. R. J. C.

Colour of Fluorescence and Solvent. Hans Stobbe (*Ber.*, 1909, 42, 790—797).—An investigation on the influence of the solvent on the colour and intensity of the fluorescence of 1-phenylnaphthalene-2 : 3-dicarboxylic anhydride.

A detailed description and sketch of the apparatus employed to observe the fluorescence of the solutions is given.

The behaviour of eighty-five solvents was investigated, and the following results obtained : (1) Solutions of the anhydride in alkyl iodides, ethers, and esters are not fluorescent. (2) Solutions in aliphatic hydrocarbons, alcohols, and acids exhibit a slight blue fluorescence. (3) The fluorescence is far more intense in brominated and chlorinated solvents, and is either dark blue or violet. Solutions in chlorinated solvents, as a rule, have an intense violet fluorescence. (4) A relationship between the dielectric constant of the solvent and the intensity of the fluorescence does not exist.

The author suggests that the change in the colour of the fluorescence is probably connected with the formation of molecular complexes, produced by the combination of the anhydride with the chlorinated or brominated solvent through the agency of the residual affinities of the halogen and anhydride. W. H. G.

Influence of Impurities on the Photo-electric Effect in Liquids. Eugène Bloch (*Compt. rend.*, 1909, 148, 621—622).—Water and aqueous solutions of sodium chloride, potassium chloride, and potassium nitrate have been examined for the Hertz-Hallwachs photo-electric effect. The positive result which is obtained when the liquids are illuminated by sparks passing between aluminium electrodes, or by a mercury arc light in a quartz vessel, has been traced to the presence of impurities. If the surface of the liquid is perfectly clean, neither water nor the aqueous solutions show the photo-electric effect.

It is suggested that the electrical conductivity of the atmosphere is in part due to the photo-electric action of solar rays on the earth.

H. M. D.

Photo-electric and Actino-dielectric Action in the Phosphorescence of the Alkaline Earth Sulphides. Philipp Lenard and Sem Saeland (*Ann. Physik*, 1909, [iv], 28, 476—502).—The electrical phenomena which are observed when the sulphides of the alkaline earth metals are exposed to light have been examined in detail. It is found that the photo-electric action is intimately connected with the phosphorescence of the sulphides and is localised in certain centres which are also the centres of light emission. The excitation of a phosphorescent substance by light or cathode rays is supposed to consist in the polarisation of these emission centres. The centres are characterised by the presence of the metallic "impurity," and the polarisation consists in the loss of electrons from the atoms of the foreign metal. The phosphorescence which follows the excitation is a result of the recombination of the electrons with the metal.

What is termed actino-dielectric action is observed when the phosphorescent substance is exposed to red light while under the influence of an electric field. It is attributed to a displacement of ions under the influence of light and is not characteristic of phosphorescent substances. H. M. D.

Calculation of Photochemical Reactions. Chr. Winther (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 66—70). —Two equations have been deduced to express the velocity of a non-reversible photochemical change, one on the assumption that the velocity is proportional to the intensity of the light at each point of the reacting system, the other on the assumption that the velocity is proportional to the light absorbed. The author compares the two equations, and shows that they are identical in the case where the photochemical change is unimolecular. The changes investigated experimentally up to the present are unimolecular; it is therefore impossible to decide whether the velocity is determined by the absorbed light or not.

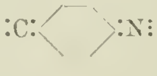
H. M. D.

Colloidal Symbiosis. Raphael E. Liesegang (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 63—64).—A discussion of the difference in the behaviour of silver bromide dry plates on developing. The greater readiness with which large molecular complexes of silver bromide are developed in comparison with small molecular complexes is examined in the light of two theories. A comparison is made between the granules of silver bromide in a photographic plate and the cells of a living organism. The fact that the protoplasmic molecular aggregates of a cell respond as a whole to the action of many chemical reagents is further supposed to be analogous to the response of complex granules of bromide to the action of the developer. This analogy leads to the conception of a colloidal symbiosis. H. M. D.

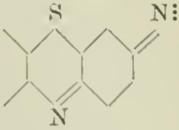
Retarding Action of Bromides in Photographic Developers as a Colloido-chemical Process. LÜPPO-CRAMER (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 92—94).—The addition of soluble bromides to the developer in order to reduce the effect of over-exposure has been found to have a considerable influence on the character of the reduced silver. If large quantities of bromide are present, the velocity of the developing process is greatly reduced, and instead of the ordinary black silver gel, a light grey-coloured form of silver is obtained. The adsorption capacity of the grey silver is very much less than that of the black variety, and this difference shows itself in the behaviour of the two forms towards ammonium persulphate when this is employed to reduce intensities. The grey silver is acted on much more quickly than the black. This has been shown by parallel experiments with two negatives, one of which was developed without addition of bromide, whilst the other was first over-exposed and then developed with the addition of bromide to counteract the effect of the over-exposure. H. M. D.

Relation between the Constitution of Dyes and their Sensitiveness to Light. KURT GEBHARD (*Zeitsch. angew. Chem.*, 1909, 22, 433—435).—The sensitiveness of a dye to light stands in close relation to the presence of definite groups in the molecule. An examination of about sixty dyes in aqueous solution leads to the conclusion that these groups, arranged in the order of increasing stability to light, can be tabulated as follows:

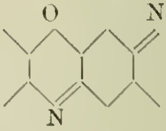
I.



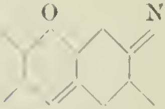
II.



III.

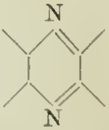


IV.



V. $\left.\begin{matrix}\cdot N{:}N\\ \cdot N{:}N\end{matrix}\right>R$

VI.



VII. ·N:N·.

The chief factor in causing sensitiveness to light appears to be quinonoid structure; a comparison of I. and IV. shows, however, that the stability is increased when one of the groupings, :C:C:, forms part of a ring. Dyes, such as Martius' Yellow, containing single linkings, are particularly stable to light.

The presence of substituents is also of great importance in determining the sensitiveness of a dye to light. These substituents have either an accelerating or a retarding influence. The most important accelerator is the hydroxyl group, its influence being well illustrated by the increasing sensitiveness of the series: Alizarin-blue-R, Alizarin-orange, Purpurin, and Alizarin-indigo-blue-J; it appears, however, that the hydroxyl groups must all be in the same benzene nucleus, Alizarin SX, for example, being more stable to light than the isomeric Purpurin. Another important accelerator is the substituted, and particularly the monosubstituted, amino-group; Rhodamine-B and Rhodamine G differ only in that the former contains a diethylaminogroup where the latter has an ethylamino-group. The latter is the more sensitive to light.

Of substituents exerting a retarding influence, the hydrogen ion is the most important. Gallein, as the acid, is more stable to light than its salts, whilst in Diamond-yellow and Diamond-flavine the retarding influence of the hydrogen ion overpowers the accelerating influence of the hydroxyl group. The sulphate, bromine, and chlorine ions also exert a retarding influence to the action of light, which is well seen in the great stability of Victoria-green as against that of Malachite-green.

Dyes which contain accelerating substituents become more stable by the introduction of retarding groups, and vice versa. Instances of the first case are Victoria-green and Malachite-green, Rose-Bengal and Tetraiodofluorescein, Rhodamine-B and Rhodamine-G; an example of the second case is Methyl-violet, which, by the introduction of the methyl group, becomes more sensitive to light than Malachite-green.

C. S.

Charges on Ions produced by Radium. C. E. HASELFOOT (*Proc. Roy. Soc.*, 1909, *A*, 82, 18—22).—Townsend has described a method for the direct determination of Ne, where N is the number of molecules in 1 c.c. of a gas at normal temperature and pressure and e the charge on an ion, and has shown that the positive ions produced by secondary Röntgen rays have in some cases a single and in others a double atomic charge, whereas the charge on the negative ions is always the same. The same method has been applied by the author to the ions produced by radium. Observations under different conditions lead to the conclusion that the positive and negative ions have the same electric charge. As in the case of the ions produced by Röntgen rays, it was found that the negative ions produced by radium do not obey the simple laws of diffusion when the air is very dry.

H. M. D.

Atmospheric Radiation of High Penetrating Power. THEODOR WULF (*Physikal. Zeitsch.*, 1909, 10, 152—157).—The results of observations of the diurnal variation of intensity of the penetrating atmospheric radiation are communicated. During October, 1908, the hourly measurements showed two maxima and two minima. In November the mid-day minimum disappeared, and in December no periodicity could be detected. The observations indicate a complete parallelism between the variation of the air potential and that of the γ-radiation.

Comparative measurements in the chalk mines of Valkenburg (15 metres below the surface) gave values for the intensity of the γ-radiation which were on the average 42% smaller than those obtained at the surface.

H. M. D.

Penetrating Radiation. DOMENICO PACINI (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 123—129).—A cylinder of polished zinc was used as recipient for the air, the internal electrode being a copper cylinder. The apparatus was established in the Apennines at a height of 1090 metres in August and September. The minimum value found for the ionisation of the air was 6·3 ions per c.c. per second. The minimum value found by McLennan in Toronto (Abstr., 1908, ii, 648) was 6·0. The ionisation has a double diurnal period. The conclusion is drawn that the source of the penetrating radiation capable of ionising the air inside a metallic cylinder is not in the soil.

C. H. D.

Distribution of the Radiation of Radioactive Substances. Heinrich Greinacher (*Physikal. Zeitsch.*, 1909, **10**, 145—152).—The author has already shown (compare Abstr., 1908, ii, 551) that the radiation from plane geometrical figures, cut from hardened masses of uranium compounds, shows a peculiar distribution. A similar distribution is observed if prismatic figures of a phosphorescing substance are brought into contact with a photographic plate. By comparison of the images yielded by a solid prism of gypsum mixed with phosphorescent paint and by an aluminium prism coated superficially with the phosphorescent material, it has been found that the "angle effect" is due to rays which proceed from the interior of the active substance.

The same angle effects are obtained when a radium preparation is enclosed in a cube of lead placed in contact with a sensitive plate. They are also produced when radium, enclosed in a cylinder of lead sufficiently thick to cut off the α- and β-rays, is brought up close behind a photographic plate in front of which a cube of lead is placed. In these circumstances, the action must be due to the secondary rays generated in the lead by the primary γ-rays from the radium. Whether the "angle effect" is, in general, due to primary or secondary rays cannot be decided, but a mathematical consideration indicates that the peculiar distribution is essentially due to the operation of Lambert's cosine law. H. M. D.

Radioactivity and Pleochroic Halos. Otto Mügge (*Centr. Min.*, 1909, 65—71, 113—120, 142—148).—The radiations of radium produce changes in the optical characters of certain minerals similar to those observed in the pleochroic halos. A detailed description is given of pleochroic halos seen in several minerals (cordierite, biotite, etc.), these halos occurring around enclosed grains of zircon, orthite, etc. The effects produced by radium bromide placed in contact with various rock-forming minerals for periods extending over several months are recorded. The most sensitive mineral is rock-salt: after three days there is a marked change in colour, and after fourteen days a dark brownish-yellow spot is produced; on heating, this spot passes through a series of colours, and finally the colour disappears. Cordierite is also readily affected, with a change in the colour and pleochroism and a diminution in the strength of the double refraction. Finally, the photographic activity of some radioactive minerals (zircon, orthite, thorite, thorianite, etc., namely, those minerals around which pleochroic halos occur in nature) was compared with the activity of uranium and of radium bromide. L. J. S.

Comparison of the Radium Emanation Spectra Obtained by Different Observers. T. Royds (*Proc. Roy. Soc.*, 1909, *A*, 82, 22—25. Compare this vol., ii, 206; Rutherford and Royds, Abstr., 1908, ii, 787; Cameron and Ramsay, 1908, ii, 786).—A comparison of the author's table of the spectral lines of radium emanation with that of Ramsay and Cameron shows that there are differences which are too large to be explained as errors in measurement or variations of intensity due to impurities. After eliminating the well-marked emanation lines, the spectrum of Cameron and Ramsay is found to be almost identical with the xenon spectrum obtained by the discharge from a Leyden jar with spark gap. The author draws the conclusion that the emanation examined by these observers was contaminated with xenon. H. M. D.

Measurements of the Active Emanation of Sea-Water from the Atlantic Ocean. W. Knoche (*Physikal. Zeitsch.*, 1909, 10, 157—158).—During the course of a voyage across the Atlantic, twelve measurements of the amount of emanation in sea-water were made. Except in one instance, a positive result was obtained, the average activity of the samples being equal to 0·1 Mache unit.

H. M. D.

Relative Ionisation Produced by Röntgen Rays in Different Gases. J. Arnold Crowther (*Proc. Camb. Phil. Soc.*, 1909, 15, 38—39).—A comparison has been made of the ionisation effects produced by "soft" and "hard" Röntgen rays in passing through various gases and vapours. The beam of rays was passed between two parallel plate electrodes, care being taken to prevent any portion of the beam falling on either electrode so as to eliminate secondary radiation effects.

Compared with air as a standard, methyl iodide, methyl acetate, and carbon dioxide show a decrease in the relative ionisation on passing from soft to hard rays; hydrogen and ethyl bromide show an increase, whilst the relative ionisation in the case of ethyl chloride and carbon tetrachloride remains nearly constant.

For the very soft rays used in the author's experiments, the ionisation in hydrogen is only 1% of that in air at the same pressure.

H. M. D.

Secondary Radiation Excited by γ-Rays. F. E. Hackett (*Sci. Trans. Roy. Dubl. Soc.*, 1909, 9, 201—218).—γ-Rays from radium bromide were allowed to fall at an angle of 45° on the lower surface of plates of different metals, and the intensity of the secondary rays, emitted from the upper surface of the plate in the plane of incidence and in a direction at right angles to the incident γ-rays, was measured by means of an ionisation chamber. The secondary radiation measured in this way is nearly constant for metals the atomic weight of which lie between 27 and 120; it is greater for tungsten, gold, platinum, mercury, lead, and bismuth, and still greater for uranium. The experimental numbers indicate that the secondary radiation per atom is approximately proportional to the atomic weight when this is less than 120, but increases more rapidly than the atomic weight when this exceeds 120. The hardness of the secondary rays diminishes with increase of atomic weight for soft γ-rays, but increases for hard γ-rays. For metals of low atomic weight the penetrating power of the secondary rays is nearly independent of the hardness of the primary rays; on the other hand, for metals of high atomic weight the hardness of the secondary rays changes in a corresponding manner with that of the primary rays. H. M. D.

Slow Cathode Rays. O. von Baeyer (*Physikal. Zeitsch.*, 1909, 10, 168—176).—The properties of the slowly moving cathode rays which are emitted by a glowing Wehnelt cathode have been examined. Experiments were made to determine the velocity and the ionising power of the rays. When the rays come into contact with metal surfaces, they give rise to a diffuse secondary radiation. H. M. D.

The Influence of Cathodic on Canal Rays. Jean Becquerel (*Le Radium*, 1908, 5, 329—330).—Partly polemical in reply to Bestelmeyer (Abstr., 1908, ii, 799). The author again refers to his observation that the canal rays are affected by the electrical charges carried to the walls of the tube by the cathode rays, and are thus displaced to a certain limited extent in the same sense as the latter. G. T. M.

Existence of Positive Electrons in Vacuum Tubes. A. Dufour (*Compt. rend.*, 1909, 148, 622—625).—Further experiments are described which confirm the author's view that the beam of rays examined by Becquerel (compare *ibid.*, 546) is a secondary beam which has its origin in the canal rays. The experimental arrangement adopted by the author agrees so closely with that used by Becquerel that there can be no doubt that the rays examined in the two series of experiments are identical. H. M. D.

A New Radioactive Product of the Uranium Series. Jacques Danne (*Compt. rend.*, 1909, 148, 337—339).—In the course of preparing a quantity of uranium-*X*, a new substance has been isolated intermediate between uranium and uranium-*X*; it is the immediate parent of the latter. This substance, *radiouranium*, is less active than uranium when fresh, but gradually increases to a maximum activity 3·35 times that of uranium in forty-four days. At the end of this time some uranium-*X* can be separated from it, when its activity falls again to the initial low value.

In order to separate radiouranium from uranium and uranium-*X*, the mixed active nitrates from 22 kilos. of uranium nitrate were treated with acetone to dissolve uranium nitrate and then with freshly precipitated ferric oxide in acetone to absorb uranium-*X* nitrate. The insoluble residue of radiouranium nitrate, calcined and converted into chloride, weighed 0·4 gram, whereas the uranium-*X* chloride obtained weighed 0·5 gram. The former was half and the latter sixty-three times as active as uranium. R. J. C.

Radioactivity of Rubidium. Norman Campbell (*Proc. Camb. Phil. Soc.*, 1909, 15, 11—12).—With the object of comparing the radioactivities of potassium and rubidium, the author has made measurements of the ionisation produced by layers of finely powdered rubidium sulphate of different thicknesses. The rubidium sulphate was specially prepared by Kahlbaum.

Denoting by a the ionising power of the total radiation from one gram of the substance when the whole of the radiation is absorbed in air, the author calculates for the two metals: potassium, $a = 2{\cdot}003 \pm 0{\cdot}0376$; rubidium, $a = 14{\cdot}47 \pm 0{\cdot}365$. On the other hand, the values of λ/ρ (where λ is the coefficient of absorption of the material for the rays it emits and ρ is the density of the material) for the metals are: potassium, $\lambda/\rho = 8{\cdot}23 \pm 0{\cdot}1$; rubidium, $\lambda/\rho = 53{\cdot}2 \pm 2{\cdot}1$.

From this it follows that, although for infinitely thick layers the activity for potassium is slightly greater than for rubidium, the intrinsic activity of the latter is at least seven times as great as that of the former. H. M. D.

Electrical Condition of Gases in the Nascent State. J. A. CUNNINGHAM and SATISH CHANDRA MUKERJI (*Jahrb. Radioaktiv. Elektronik*, 1907, 4, 370—375).—The electrical condition of the oxygen evolved by heating various oxygen compounds has been investigated. The oxygen, generated by heating the substances in a hard glass tube, was made to pass through a cylinder along the axis of which an insulated rod was supported, this being connected with one of the pairs of a quadrant electrometer. The rod and the inside of the cylinder were silver plated, and the cylinder was connected with one or other of the poles of a battery of 280 volts. From the movements of the electrometer needle, the approximate number of ions per c.c. of gas has been calculated. The conductivity of the oxygen depends on the substance from which it is evolved, and diminishes in the series: potassium chlorate, potassium perchlorate, potassium permanganate, sodium peroxide, mercuric oxide. In the case of potassium chlorate and sodium peroxide the conductivity of the oxygen was found to vary according as the cylinder was positively or negatively charged. H. M. D.

Conduction of Electricity. JOHANN KOENIGSBERGER (*Zeitsch. Elektrochem.*, 1909, 15, 97—105).—Metallic conductivity is distinguished from electrolytic conductivity by (1) absence of products of electrolysis; many metallic oxides and sulphides conduct electricity without decomposition. (2) Absence of polarisation. Pure adularia, $KAlSi_3O_8$, at temperatures below 1070° exhibits an apparent polarisation of a few millivolts, but this is shown to be of thermoelectric origin, due to differences of temperature at the junctions produced by the Peltier effect. A true electrolyte, such as solid barium sulphate, gives a polarisation of more than 1 volt. (3) From Nernst's law of partition it appears probable that a substance which dissolves (without decomposition) in water to a solution containing ions will be an electrolytic conductor in the solid state. (4) The resistance of a pure solid conductor has a minimum value at some temperature, whereas the resistance of a solid electrolyte always diminishes as the temperature rises. (5) Electrolytic conductors exhibit selective absorption and emission in the ultra-violet and infra-red, whereas with metallic conductors the absorption and emission are continuous.

The resistance, w, of a metallic conductor at $t°$ is given by the expression: $w_0(1+at\pm\beta t^2)e^{-q}\frac{t}{(t+273)(273)}$, where w_0 is the resistance at 0°, a and β the temperature-coefficients of pure metals, 0·003 and 0·000002 respectively, and q is one-half of the heat of dissociation of a negative electron. In addition to the oxides and sulphides of many metals, cuprous iodide and a number of silicates at temperatures below 1000° exhibit metallic conductivity. The effect of impurities in diminishing the conductivity is much smaller for substances with a large value of q than for those with a small value.

The heat evolved by the combination of a negative electron with a gram-atom of an element is evaluated approximately. For the alkali metals it is under 50, for the alkaline earth metals under 100, for hydrogen greater than 500, for graphite 700, silicon 600, titanium 300, zirconium 100, boron 100, aluminium less than 40, and for most of the remaining metals under 20; the electronegative elements, nitrogen, chlorine, etc., have very large values, probably larger than 10,000. The values for some sulphides and oxides are also given. T. E.

Electro-capillary Action and Discharge in Rarefied Gases. G. Reboul (*Compt. rend*, 1909, **148**, 617—618).—Experiments are described which show that the formation of drops of mercury in an exhausted tube facilitates electrical discharge. The apparatus used consisted of a tube provided with two electrodes, the upper one being an ordinary disk electrode, the lower one a nickel tube perforated at its upper extremity by a small hole at which drops of mercury could be formed. The two electrodes were connected by a battery of accumulators.

When the potential difference is approximately equal to that required for discharge, it is found that the formation of the drops of mercury facilitates the discharge whether the mercury is positively or negatively charged. If the mercury is negatively charged, the formation of the mercury drops permits disruptive discharge to take place when the potential difference is 10 or 20 volts lower than that required for the discharge under ordinary conditions. It is supposed that the drop formation is accompanied by the liberation of ions, and the greater effect observed when the mercury is negatively charged is attributed to the greater mobility of the negative ions. The variation in the superficial area of the drops may also diminish the difference of potential at the air-mercury surface, and this action appears to be the dominant one at low pressures. If, when the pressure is sufficiently low, the phosphorescent stage has been reached, the formation of drops at the cathode inhibits the phosphorescence effect. H. M. D.

Carriers of the Positive Charges of Electricity Emitted by Hot Wires. Sir Joseph J. Thomson (*Proc. Camb. Phil. Soc.*, 1909, **15**, 64).—The value of e/m has been determined for the positively charged particles emitted by a heated strip of platinum wire which had been kept for several days in a high vacuum and heated repeatedly to incandescence. The number obtained shows that the mass of the particles was about twenty-seven times the mass of a hydrogen atom. The gas given off by the hot wire after prolonged heating gave a bright carbon monoxide spectrum, whilst that of nitrogen could not be detected. From this observation the author draws the conclusion that the carriers of the positive electricity are carbon monoxide molecules.

After heating the platinum to a red heat in an atmosphere of hydrogen, the value of e/m showed that the average mass of the carriers was only eight or nine times that of the hydrogen atom. This is in agreement with the view that the carriers of the positive electricity given out by hot metals are, for the most part, the molecules of gas absorbed by the metal. H. M. D.

Tables of Molecular Conductivities. PHILIP BLACKMAN (*J. Physical Chem.*, 1909, **13**, 144—153).—Tables are given of the molecular conductivities of a large number of salts at 18° and 25°, calculated by the method already described (Abstr., 1906, ii, 647). G. S.

Piezochemical Studies. ERNST COHEN and L. R. SINNIGE (*Zeitsch. Elektrochem.*, 1909, **15**, 76—77).—The increase of *E.M.F.* of a galvanic cell with the pressure (at constant temperature) $(dE/d\pi)_T$ has been shown by Willard Gibbs to be equal to $-(dV/de)_T$, where dV is the change of volume of the cell due to the passage of a quantity of electricity, de.

For the cell Cd | $CdSO_4$ solution | 12·5%Cd amalgam the quantity dV/de is a constant; the authors find that $dE/d\pi$ is constant, and equal to 0·0000196 volt per atmosphere between 0 and 1000 atmospheres.

The authors show further that it is possible to determine the effect of pressure on the solubility of a salt by measuring the effect of pressure on the *E.M.F.* of cells containing electrodes reversible with respect to the anion and cation of the salt and a saturated solution of the salt, in one case with the solid salt, in the other case without it. The experimental results are reserved for a later communication. T. E.

Calculation of Electromotive Forces from Thermal Data. WALTHER NERNST (*Sitzungsber. K. Akad. Wiss. Berlin*, 1909, 247—267).—In a previous paper (Abstr., 1907, ii, 153), the author has deduced the following expressions for condensed systems: $Q = Q_0 + \beta T^2 + \gamma T^3 + \ldots$ (1) and $A = Q_0 - \beta T^2 - \gamma/2.T^3$ (2), where Q represents the heat of reaction and A the available energy. β and γ are constant for any one system, and can be calculated by means of the equation $dQ/dT = C_1 - C_2 = 2\beta T + 3\gamma T^2 + \ldots$, where $C_1 - C_2$ represents the difference of the heat capacity before and after the transformation of one gram-equivalent. At temperatures not too far from the absolute zero, A is approximately equal to Q, and therefore the *E.M.F.* of a galvanic combination may be calculated from purely thermal data as follows. The thermal data obtained at the ordinary temperature are extrapolated to as low a temperature as possible, then the *E.M.F.*, E, is calculated from the value of Q by means of the equation $Q = A = FE$, where $E = Q/23{,}046$, when the *E.M.F.* is expressed in volts. Then, by means of equation (2) above, the value of the *E.M.F.* is calculated for any required temperature and compared with the experimental value.

The theory is tested by application to a number of reactions, including some in which gases are concerned, and it is shown that, in general, there is good agreement between the observed and calculated values of E. The equations do not apply in the first instances to gas elements, but it is shown that the *E.M.F.* of the latter may be calculated from thermal and vapour-pressure data. G. S.

Asymmetry due to the Passage of a Continuous Current through a Chain of Aqueous Solutions of Electrolytes with a Common Ion. M. Chanoz (*Compt. rend.*, 1909, **148**, 618—621).—The author has examined the potential differences which are set up at the liquid interfaces when a continuous current is passed through a series of solutions arranged according to the scheme MR | M'R' | MR. The potential differences, which are opposite in sign, are due to the changes in concentration which are brought about by the electrolytic conduction. When the two different solutions contain a common anion, the middle electrolyte increases in concentration at the surface at which the current enters, and at the opposite surface if the solutions contain a common cation. H. M. D.

Heat of Ionisation and the Ionisation Constant of Water. Adolf Heydweiller (*Ann. Physik*, 1909, [iv], **28**, 503—512).—The new data for the mobilities of the hydrogen and hydroxyl ions and for the influence of temperature on the mobility of these ions as well as on the heat of neutralisation and on the electrical conductivity of solutions of acids, bases, and salts have been utilised for a recalculation of the heat of ionisation of water and of the ionisation constant.

The heat of ionisation (s) and its variation with the temperature (t) is given by the equation $s = 14617 - 48{\cdot}5t$. This agrees very well with the equation recently obtained by Noyes. The quantity of ionised water in 1 c.c. of the liquid at different temperatures is given by $\log a = 30{\cdot}2339 - 3047{\cdot}3/T - 12{\cdot}125 \log T$. For the ionisation constant $K_w = (a')^2/1 - a'$, in which $a' = 1000a$, the following values have been calculated.

Temperature	0°	10°	18°	25°	50°	100°	150°	200°
$K_w \cdot 10^{14}$	0·116	0·281	0·59	1·04	5·66	58·2	234	525

These are about 25% larger than the values obtained by Noyes.
H. M. D.

Reducing Action of Electrolytic Hydrogen on Arsenious and Arsenic Acids when Liberated from the Surface of Different Elements. William Thomson (*Proc. Roy. Soc. Edin.*, 1909, **29**, 84—95).—The apparatus used has already been described (Abstr., 1904, ii, 777). Thirteen different elements were used as cathodes, and the order of their efficiency in removing arsenious acid from solution as arsenic trihydride is as follows : lead, zinc, cadmium, tin, silver, graphite, iron, platinum, aluminium, gold, cobalt, nickel, and palladium. The order for the removal of arsenic acid is not quite the same. These results disprove the suggestion of Chapman and Law (Abstr., 1906, ii, 196) that the efficiency of hydrogen with respect to arsenious and arsenic oxides depends largely on the supertension of the cathode. For example, silver, with a very low supertension, liberates arsenic as the trihydride from arsenious acid with about the same velocity as lead or zinc, which have very high supertensions. Further, palladium, which has a comparatively high supertension, is at the bottom of the series as regards efficiency in decomposing either arsenious or arsenic acids.

The rate at which arsenic is removed from solution in the presence of the different metals has also been determined, and the results are given in tables and curves. In the case of lead, zinc, cadmium, tin, and silver, the reduction proceeds as a unimolecular reaction when arsenious acid is employed. G. S.

Migration Constants of Dilute Solutions of Hydrochloric Acid. C. Chittock (*Proc. Camb. Phil. Soc.*, 1909, 15, 55—63).—The experiments were undertaken with the object of throwing light on the cause of the abnormally low electrical conductivity of very dilute aqueous solutions of strong acids and bases. The apparatus used was so arranged that a comparatively small volume of the solution in the neighbourhood of each electrode could be separated from the rest. This volume of solution was large enough to contain the whole region in which any change of concentration had taken place, and, after stirring to obtain homogeneity, the concentration of the electrode solutions was ascertained by measuring the electrical conductivity by means of two subsidiary electrodes. In all the experiments the electrolysing current was kept small enough to prevent any evolution of chlorine at the anode.

The transport ratio of the chlorine ion was found to increase from 0·171 at a concentration of 0·001405 equivalent per litre to 0·275 at a concentration of 0·0001006. The change in the migration constant is much greater than that which was observed by Whetham and Paine in the case of dilute solutions of sulphuric acid.

The author concludes that the change is too great to be explained by a decrease in the mobility of the hydrogen ion. On the other hand, if the water used as solvent contained a trace of ammonia, the observed results may probably be explained, for the effect of the presence of ammonia would be to replace the hydrogen ion by the much less mobile ammonium ion, the extent of the replacement increasing with the dilution. H. M. D.

Electrolysis of Alkali Chlorides. Electrical Conductivities, Densities, and Specific Heats of Solutions of Potassium Chloride and of Potassium Hydroxide. Adrien Jaquerod (*J. Chim. Phys.*, 1909, 7, 129—151).—The electrical conductivities and densities of solutions of potassium chloride containing 70·4, 140·8, 211·2, and 281·6 grams of the salt per litre, of solutions containing about 50, 100, 150, and 200 grams of potassium hydroxide per litre and of solutions containing mixtures of these salts in varying proportions, have been measured at intervals of temperatures from 20° to 80°. Specific heat measurements with the same solutions were made at room temperature.

The conductivity measurements were made by Kohlrausch's method, and the results are given in tabular form. The results of the measurements of the density of solutions containing known amounts of potassium chloride and of potassium hydroxide are represented at temperatures from 20° to 80° by means of the formula

$$d_t = \frac{0{\cdot}9957 + 0{\cdot}000616P_{\mathrm{KCl}} - 0{\cdot}00000013P^2_{\mathrm{KCl}} + 0{\cdot}000855P_{\mathrm{KOH}} - 0{\cdot}0000003SP^2_{\mathrm{KOH}}}{1 + 0{\cdot}00045(t - 30)}$$

where P represents the weight of solute in grams per litre at room temperature.

The measurements of specific heat were made in a silver calorimeter by dropping a ball of silver warmed to 100° into the solution in question. The results for potassium chloride are represented by the formula $C = 1 - 0{\cdot}001264p + 0{\cdot}00000111p^2$, and those for the hydroxide by the analogous formula $C = 1 - 0{\cdot}00142p + 0{\cdot}0000021p^2$, where p represents the concentration of the solution in grams per litre.

G. S.

Influence of Foreign Substances on the Thermo-electric Properties and the Resistivity of Aluminium. H. Pécheux (*Compt. rend.*, 1909, 148, 627—628).—The thermo-electric properties and the resistivity of three samples of commercial aluminium containing small quantities of iron, silicon, and carbon have been examined. The thermo-electric force of the aluminium copper couple is diminished by the presence of small quantities of iron and silicon in the aluminium. The variation of the *E.M.F.* with the temperature corresponds approximately with a parabolic curve.

The resistance measurements indicate that the resistivity of aluminium is increased by the presence of small quantities of iron and aluminium, and that the temperature-coefficient of the resistivity increases as the proportion of impurities increases.

H. M. D.

Magnetic Properties of Several Easily Liquefied Gases. P. Pascal (*Compt. rend.*, 1909, 148, 413—415).—The magnetic susceptibilities of a number of liquefied gases were determined by observing the difference in level when one arm of the quartz U-tube containing the liquid was placed in a powerful magnetic field. The values obtained were: SO_2, $-2{\cdot}97.10^{-7}$; NH_3, $-11{\cdot}15.10^{-7}$; C_2N_2, $-4{\cdot}32.10^{-7}$; N_2O_3, $-3{\cdot}03.10^{-7}$; N_2O_4, $-2{\cdot}75.10^{-7}$; $CH_3{\cdot}NH_2$, $-9{\cdot}06.10^{-7}$; CH_3Cl, $-6{\cdot}67.10^{-7}$; Cl_2, $-5{\cdot}90.10^{-7}$.

It was assumed that molecular susceptibility, like rotatory power, is the same in liquid and gaseous states, and the magnetic susceptibilities of the gases at 0° and 760 mm. were calculated. They are all of the order 10^{-9}.

The molecular susceptibility (susceptibility × molecular weight) of the various gases is roughly a linear function of the number of atoms in the molecule; thus magnetic susceptibility appears to follow a law similar to that of Dulong and Petit for specific heats.

R. J. C.

Determination of Melting Points. Sidney W. Bunker (*Pharm. J.*, 1909, [iv], 28, 324).—In order more readily to determine the melting point of substances which are not easily introduced into a narrow tube—for instance, benzoic acid and, more especially, waxes—the following apparatus has been devised. Fig. 1 represents in section the receptacle for the substance the m. p. of which is to be determined. *a* is a brass ring, upon which rests a rubber washer, *b*, and then comes a $\frac{3}{4}''$ circular, microscopic cover-glass, *c*, which is separated from a second cover-glass, *e*, by a platinum disk, *d*. In the centre of this platinum disk a hole is cut, in which is placed the substance to be examined, and above the second cover-glass, *e*, a rubber washer, *f*, is placed. These all rest on the flange of *a*; the brass top, *g*, is then screwed down tightly to prevent the entrance of water or oil, or whatever the heating-bath consists of. Fig. 2 indicates the manner in which this arrangement is attached to the thermometer by means of rubber rings, *r*, round the side screws, *h*, the whole being supported in a beaker containing the liquid constituting the bath.

Fig. 1.

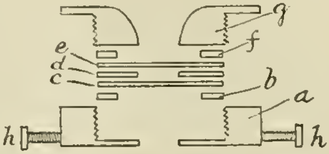
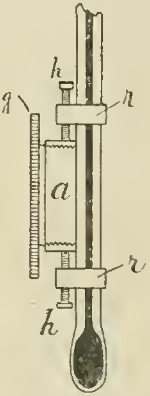


Fig. 2.



Below 190° rubber bands may be used to attach the apparatus to the thermometer, and above 100° thin leather or kid washers must be substituted for the rubber washers *b* and *f*.

The advantages claimed for this method of determining m. p.'s are that in many cases (especially with waxes) it is more rapidly carried out; the thickness of the layer experimented on is always equal to the thickness of the platinum disk, *d*; the cover-glasses are almost uniform in thickness; and it is easier to observe a flat surface than the rounded sides of a capillary tube.

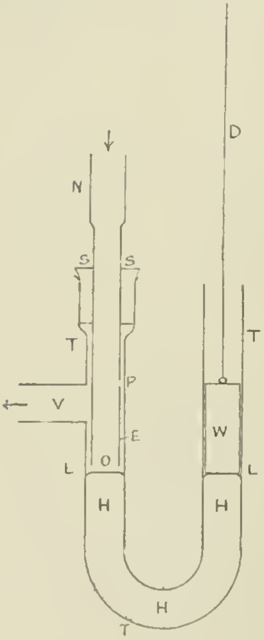
J. V. E.

Dependence of the Melting Point of a Solid Substance on its Surface Energy. P. Pawloff (*Zeitsch. physikal. Chem.*, 1909, 65, 545—548).—In continuation of previous work (this vol., ii, 19), a formula connecting the melting point of a particle and its radius is deduced, and the three cases in which, at the melting point of the particle, the vapour pressure over the plane surface of the liquid is respectively greater than, less than, or equal to, the vapour pressure over the plane surface of the solid are discussed and represented graphically. Only the first case has been experimentally realised.

G. S.

An Electrically-controlled Gas Regulator. E. Emmet Reid (*Amer. Chem. J.*, 1909, 41, 148—152).—The new regulator consists of a U-tube, *TT*, provided with a side-tube, *V*, and having one limb enlarged at the top to receive an india-rubber stopper, *SS*, through which passes the tube *NO*, with an external diameter 1 mm. less than the internal diameter of the U-tube. The latter is filled with mercury (*HHH*) to a level about 1 mm. below the end of the tube *NO*. *W* is an iron weight 15—20 mm. long and 1 mm. less in diameter than the U-tube; it is suspended from a lever attached to the armature of an electro-magnet. The armature is ordinarily held up by a spring, but when attracted by the magnet the weight falls 1—2 mm. The passage of the gas is shown by the arrows. If the coils of the electro-magnet are in series with any form of electrical regulator in which contact is made when a certain temperature is exceeded, then, in the latter event, *W* falls, drives the mercury up to close the end of *NO*, and so prevents the passage of all gas except that which can pass through a pin-hole, *P*. The latter acts as a by-pass. The high surface-tension of mercury prevents the latter rising between the weight, *W*, and the walls of the U-tube. Another form of regulator based on the same principle is described, in which the entire apparatus is made of metal, thus avoiding all danger of fire.

E. H.



Thermo-dynamic Equilibrium and Stability. Joseph E. Trevor (*J. Physical Chem.*, 1909, 13, 154—156).—A mathematical discussion of the conditions that must be satisfied to ensure that a given *r*-phase state of an *n*-component substance shall be a stable thermo-dynamic state.

G. S.

Heat of Formation of Aniline and Some of its Derivatives. Frédéric Swarts (*Bull. Acad. roy. Belg.*, 1909, 43—59).—The differences between the values obtained by Petit (Abstr., 1888, 1239) for the heats of combustion of *o*-, *m*-, and *p*-toluidine [964·7 cal., 965·6 cal., and 958·8 cal. (solid) respectively] and that obtained by the same author for aniline (818·5 cal.) are about 10 cal. less than the mean difference (157 cal.) between the heats of combustion of two immediate homologues. For the heat of combustion of aniline, Stohmann (Abstr., 1897, ii, 359) found the value 810·2 cal., Thomsen 829·9 cal., whilst Lemoult (Abstr., 1907, ii, 10) obtained 815·3 cal. Moreover, Stohmann has formulated the rule that the heats of combustion of isomeric compounds are the greater the greater the reactivity of the isomeride, and according to the results of Bredig (Abstr., 1894, ii, 229) and of Farmer and Warth (Proc., 1904, 20, 244), the affinity constants of *o*-, *m*-, and *p*-toluidine increase in the order named, whence their heats of combustion should, contrary to Petit's results, lie in the same order. In order to fix the heat of combustion of aniline and determine whether the toluidines form an exception to Stohmann's rule, the author has determined the heats of combustion of these compounds and some of their derivatives, and has obtained the following results: Aniline, 816·76 cal. (– 9·46 cal.); *o*-toluidine, 969·93 cal. (0·7 cal.); *m*-toluidine, 965·72 cal. (4·9 cal.); *p*-toluidine (solid), 969·31 cal. (+ 1·3 cal.); (liquid) 973·5 cal. (– 2·9 cal.); aceto-*o*-toluidide, 1174·61 cal. (53·6 cal.); aceto-*m*-toluidide, 1174·72 cal. (53·5 cal.); aceto-*p*-toluidide, 1174·31 cal. (53·9 cal.). The first figure refers to the heat of combustion at constant pressure; the second, in brackets, to the heat of formation. Thus the author's value for the heat of combustion of aniline accords well with the mean (816·9) of Petit and Lemoult's results adopted by the latter as correct. The value obtained for *m*-toluidine makes this substance an exception to Stohmann's rule unless the value is invalidated by the substance used being impure, but those for the other two isomerides differ from Petit's results and accord with the affinity constants. It is pointed out that the suppression of the basic function of the toluidines by acetylation has removed the difference between their heats of combustion. E. H.

Heat of Formation of Some Organic Fluorine Compounds. III. Frédéric Swarts (*Bull. Acad. Roy. Belg.*, 1909, 26—42. Compare Abstr., 1907, ii, 9; 1908, ii, 354).—By combustion in a calorimetric bomb, the author has determined the heats of formation of the following compounds. The first value following the name of the compound is the heat of combustion at constant pressure, and the second, in brackets, its heat of formation. ββ-Difluoroethylamine, 326·01 cal. (66·69 cal.); tetrafluorodiethylamine, 566·04 cal. (116 cal.); tri-ω-fluoro-*m*-toluidine, 830·7 cal. (83·5 cal.); tri-ω-fluoroaceto-*m*-toluidide, $CF_3 \cdot C_6H_4 \cdot NHAc$, 1042·81 cal. (128·99 cal.); fluoroacetamide, 249·55 cal. (92·8 cal.); difluoroacetamide, 208·39 cal. (115·11 cal.); difluoroacetanilide, 944·82 cal. (82·7 cal.). The values given are the mean of from three to seven experiments with each substance. *Difluoroacetanilide*, $CHF_2 \cdot CO \cdot NHPh$, prepared by heating equal molecular quantities of difluoroacetic acid and aniline in sealed tubes at 170° for forty-eight hours, crystallises in spangles, m. p. 52·4°, b. p. 259·8°.

Difluoroacetamide, prismatic crystals, m.p. 51·8°, b.p. 108·63°/35 mm., is prepared by acting on ethyl difluoroacetate with concentrated ammonia at –10°.

Comparison of the heats of formation thus determined with the values for the compounds in which fluorine has been replaced by hydrogen shows that the decrease corresponding with the replacement of a fluorine by a hydrogen atom varies from a minimum of 17·3 to a maximum of 26·2 cal. It is found also that the differences between the heats of formation of the fluoroamines and the amines, and between those of the fluoroamides and the amides themselves, are of the same order as those between the alcohols and acids and their fluoro-derivatives.

E. H.

Compressibility of Gases between 0 and 3 Atmospheres at all Temperatures. Anatole Leduc (*Compt. rend.*, 1909, **148**, 407—410).—The author shows that the equation he put forward (Abstr., 1897, ii, 133) to express the deviation of a gas from Boyle's law in terms of the pressure is not contradicted by Rayleigh's researches, since, according to the equation, if the pressure is very small the deviation will be infinitesimal and the gas will appear to obey Boyle's law as perfectly as Rayleigh found.

The deviation from Boyle's law $(1 - pv/p_0v_0)$ is equal to $(mp + np^2)$, where m and n are constants for each gas. In gases which obey the law of corresponding states, m and n should be functions of the critical constants. Ether, hydrogen phosphide, and hydrogen sulphide are less compressible, and ammonia is more compressible than the theory demands.

R. J. C.

A Means of Holding the Weighed Tube Used in the Determination of Vapour Density by the Displacement Method. Robert Brandenburg (*Chem. Zeit.*, 1909, **33**, 192).—The small tube containing the weighed sample of substance to be examined is placed in a suitable iron or nickel jacket, and by means of a small electro-magnet or permanent magnet it is retained in the upper part of the inner vapour tube until the operator has closed the apparatus. By this means no loss is occasioned by the weighed sample falling quicker than the vapour tube can be closed, and on removing the magnet the small tube falls to the bottom.

J. V. E.

Simple Method for Determining Vapour Densities. Philip Blackman (*Chem. News*, 1909, **99**, 87—88).—A more accurate formula is given for the calculation of vapour densities determined by the author's method (compare Abstr., 1908, ii, 157, 564; this vol., ii, 21).

G. S.

Simple Method for Determining Vapour Densities. III. Philip Blackman (*Zeitsch. physikal. Chem.*, 1909, **65**, 549—552. Compare preceding abstract).—A discussion of some details of the apparatus, and the precautions to be observed, particularly with reference to the manometer, in determining vapour densities by the author's method.

G. S.

Simple Method for Determining Vapour Densities. VI. Philip Blackman (*J. Physical Chem.*, 1909, **13**, 138—143. Compare preceding abstracts).—The density and hence the degree of dissociation of phosphorus pentachloride, chloral hydrate, and aldehyde ammonia have been determined by the author's method. The following are the degrees of dissociation under certain experimental conditions described in the paper: phosphorus pentachloride, 24·2% at 170°, 54% at 210°, and 79·2% at 250°; chloral hydrate, 10·89% at 107° and 56·41% at 120°; aldehyde ammonia, 72% at 103° and 98% at 106°. G. S.

Regulation of Temperature in the Measurement of Osmotic Pressure. HARMON N. MORSE and W. W. HOLLAND (*Amer. Chem. J.*, 1909, **41**, 92—117).—The importance of keeping the temperature of the osmotic cell as nearly constant as possible during the measurement of the osmotic pressure lies in the fact that the cell, being filled with a liquid having a high coefficient of expansion, and being attached to a manometer of small bore, acts as a sensitive thermometer, and "thermometer effects" caused by fluctuating temperature cannot possibly be distinguished from true osmotic effects. Moreover, since after the development in a cell of the maximum osmotic pressure of a solution the transference of the solvent through the membrane becomes very tardy, full recovery from a change in temperature occupies a very long time. Further, it is important that the cell should be filled at the same temperature as that at which the osmotic pressure of the contained solution is to be measured, otherwise the concentration of the solution will be altered.

The present paper is devoted to a description of the successive attempts to secure a constant temperature in the baths employed in the work described previously (Abstr., 1901, ii, 543; 1902, ii, 553; 1903, ii, 272; 1904, ii, 651; 1905, ii, 575; 1906, ii, 600, 601; 1907, ii, 439, 440, 553; 1908, ii, 671, 759, 1019, 1020; this vol., ii, 216). The apparatus finally adopted, which is based on the principle of causing the water in the bath to pass rapidly first over a continuously cooled surface, second, over a heated surface controlled by a thermostat, and third, over the cooled surface again, is described in detail with diagrams. Although this apparatus prevented the temperature of the water in the bath from varying more than 0·01°, the variation in temperature of the supernatant air was much greater; accordingly, similar apparatus was provided to keep also at a constant and similar temperature the air in the room in which the bath was situated.

A new form of thermostat is described. E. H.

Laws of Mobility and Diffusion of the Ions Formed in Gaseous Media. E. M. WELLISCH (*Proc. Camb. Phil. Soc.*, 1909, **15**, 1—10).—Expressions are deduced for the coefficient of diffusion of an ion through a gas, and also for its mobility; these involve only known physical constants. An ion is supposed to consist of two elements: (1) a mass nucleus surrounded by a sphere of force; (2) an electric charge, the effect of which is to increase the radius of the sphere of force without altering the mass. As the ion moves through the gas, its charge attracts the neutral molecules, resulting in an increase in the frequency of the collisions and a diminution of the mean free path.

The calculated mobility agrees with that observed for several gases, but in the case of ammonia, ethyl alcohol, ethyl chloride, and carbon tetrachloride there are considerable differences. The calculated coefficients of diffusion for air, hydrogen, oxygen, and carbon dioxide agree only moderately with Townsend's experimental values.

H. M. D.

Coefficient of Diffusion of the Emanation of Actinium. G. Bruhat (*Compt. rend.*, 1909, **148**, 628—631).—Experiments have been made which show that the diffusion of the emanation of actinium into air and other gases is regulated by the same laws as those which determine the diffusion of ordinary gases and vapours. The rate of diffusion into air is inversely proportional to the pressure of the air, and varies as the square of the absolute temperature. From a comparison of the rate of diffusion of the emanation with that of ethyl ether, ethyl alcohol, water, and carbon dioxide, the author concludes that the molecular weight of the emanation is about 70. H. M. D.

Reaction-Velocity and Diffusion. Ferencz Jüttner (*Zeitsch. physikal. Chem.*, 1909, **65**, 595—623).—In connexion with the Noyes-Whitney-Nernst theory as to the dependence of the velocity of reaction in heterogeneous systems on the rate of diffusion, the author deduces some very complicated equations which are intended to represent the course of the reaction in certain special cases. G. S.

Diffusion through Membranes. Casimir Jabłczynski (*J. Chim. Phys.*, 1909, **7**, 117—128).—The apparatus consists of a flat, circular dish divided into two equal portions by a vertical partition, part of which consists of a circular piece of cigarette paper. Each compartment is provided with a stirrer. The dish is supported horizontally in a thermostat at constant temperature; the solution to be examined is placed in one compartment and water in the other, and the stirrers started. After a few minutes, portions of the solutions are removed simultaneously with a special form of double pipette and analysed.

Experiments were made with solutions of sodium chloride, of potassium chloride, and of hydrochloric acid of different concentrations. The results appear to be accurate to about 2%, and the advantages of the method are its rapidity and the fact that the results are not disturbed by shaking, which is a drawback of the usual methods. On the other hand, the method only gives comparative results. G. S.

Free Pressure in Osmosis. L. Vegard (*Proc. Camb. Phil. Soc.* 1909, **15**, 13—23).—Measurements have been made of the velocity with which water passes through a semi-permeable membrane under different hydrostatic pressures, and also of the velocity of osmosis for aqueous solutions of sucrose of different concentrations. In the first case the velocity is proportional to the pressure. In the osmotic flow, the initial velocity is abnormally high, and gradually falls until a steady state is reached. This state sets in more quickly and is more pronounced for dilute than for more concentrated solutions; it is also dependent on the soundness of the semi-permeable membrane. If the frictional and osmotic velocities are plotted on the same diagram as a function of the hydrostatic and osmotic pressures respectively, it is found that the friction line is a tangent to the osmotic curve at the zero point. From this relationship the conclusion is drawn that the work required for the osmotic passage of water through the membrane is equal to that required for pressing the pure solvent through with a velocity equal to the osmotic velocity. It follows from this that in osmosis there is a motion of pure water through by far the greatest part of the membrane. In passing through the membrane from the side of the pure solvent, the pressure falls to a miminium value and then increases to the pressure of the solution. In the latter region the motion takes placed against the pressure fall and cannot be a motion of the fluid in bulk, but is an inter-molecular motion maintained by the energy which becomes available when the two liquids are brought into contact. The difference between the pressure on the solvent and the minimium pressure is called the free pressure of osmosis. For small velocities this free pressure is equal to the osmotic pressure. H. M. D.

Osmotic Studies. Louis Kahlenberg (*J. Physical Chem.*, 1909, **13**, 93—113).—In reply to the criticisms of Cohen and Commelin (Abstr., 1908, ii, 811) on his earlier work (Abstr., 1906, ii, 337), the author maintains that they have failed to show that stirring is unnecessary in measuring osmotic pressures; the criterion is not that fairly concordant results may be obtained without stirring, but that, in comparable experiments, higher pressures are always obtained when the solution is stirred.

Three additional observations of the osmotic pressure of a 0·125 normal solution of sucrose in pyridine at 0° have been made by the previous method. The highest pressure observed was only 23 cm. of the osmotic liquid; this developed within ten hours, remained constant for three days, and then began to diminish. This supports the author's previous statement that the osmotic pressure of such solutions is very much smaller than the gas pressure.

The osmotic apparatus used by Cohen and Commelin is adversely criticised, and the author maintains the validity of his previous results in all respects. G. S.

Solutions in Mixtures of Alcohol and Water. Ernst Cuno (*Ann. Physik*, 1909, [iv], **28**, 663—664. Compare Abstr., 1908, ii, 160).—In reference to the author's previous paper, it is pointed out that the miscibility of ethyl alcohol and water in presence of potassium carbonate has been also examined by J. M. Bell (compare Abstr., 1905, ii, 684). The two series of observations agree satisfactorily. H. M. D.

Ultramicroscopic Observations on Crystalline Liquids. P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1909, **4**, 59—62; *J. Russ. Phys. Chem. Soc.*, 1909, **41**, 28—33).—*p*-Azoxyanisole, anisaldazine, cholesteryl propionate, and cholesteryl benzoate have been examined by means of the ultra-microscope during the transition from the isotropic liquid through the anisotropic liquid to the crystalline, solid condition. The observations made confirm the author's view that the crystalline, liquid condition is characterised by the presence of very small, crystalline particles, in which the forces which determine crystalline form are developed to only a relatively small extent. H. M. D.

Spontaneous Crystallisation. René Marcelin (*Compt. rend.*, 1909, **148**, 631—633).—The author's observations on the spontaneous crystallisation of solutions of lead acetate lead to the conclusion that, other things being equal, the power of spontaneously crystallising decreases with increase in the time during which the system has been maintained in the liquid condition, and is independent of the number of times the solution has been crystallised. With increase in the temperature at which the liquid has been heated, the power of crystallising spontaneously diminishes. The observed facts cannot be explained on a molecular kinetic hypothesis, or on the assumption that the crystallisation is due to the presence of crystalline nuclei in the supercooled liquid. On the other hand, the view that the crystallisation is due to particles of foreign suspended matter, is in agreement with the observations.

It has been found in the case of supercooled solutions of potassium nitrate that finely-powdered substances are much more effective in inducing crystallisation than the same substances in the form of larger particles. The action of the small particles is supposed to be similar to the action of these in the condensation of supersaturated vapours. H. M. D.

Gaps in Isomorphous Mixtures. Wladimir I. Vernadsky (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 139—149).—Denial of the existence of gaps in isomorphous mixtures is not in accord with observed facts, such gaps being especially marked in the case of minerals, and also existing in other cases (compare Stortenbeker, Abstr., 1903, ii, 470; Muthmann and Kunze, Abstr., 1895, ii, 7; Gossner, Abstr., 1908, ii, 366). T. H. P.

Adsorption (Dyeing) and Cohesion (Felting) of Woollen Fibres and Swelling Affinity. Ed. Justin-Mueller (*Zeitsch. Chem. Ind. Kolloide*, 1909, **4**, 64—70).—The adsorption phenomena which are observed with adsorbents, such as animal and wood-charcoal, are not comparable with those which are met with in the case of absorbents, such as cotton and wool fibres, which undergo a process of gelatinisation in contact with the medium containing the adsorbable substance. Comparative measurements of the extent to which wool fibres stick together after heating for several hours at 100° in distilled water, dilute solutions of sulphuric acid, and in a natural water containing a large proportion of lime, have been made. Both acid and alkali accelerate the gelatinisation process. Measurements were also made of the amounts of various colouring matters absorbed by blood-charcoal, wood charcoal, and wool from aqueous solutions. The variation of the adsorption with the temperature, and the influence of acids and alkalis on the adsorption, indicate that the adsorption process in the case of woollen fibres is quite different from that of the charcoal. Whereas the cause in the latter case is to be found in capillary affinity, the adsorption by wool fibres is due to what the author terms "swelling affinity." H. M. D.

The Borderland between Colloidal Chemistry, Mineralogy, and Geology. Cornelio Doelter and Felix Cornu (*Zeitsch. Chem. Ind. Kolloide*, 1909, **4**, 89—92).—A collection of notes relating to the structure of naturally-occurring substances from the standpoint of colloidal chemistry. The relationship pointed out by Cornu (this vol., ii, 222), that for every simple mineral colloid there is a corresponding crystalloid, is termed the "homoisochemite" law. Mineral colloids which correspond in composition with such crystalloids are called pseudo-stoicheiolites. A sub-division of mineral colloids is suggested, depending on the number of adsorbed compounds. H. M. D.

Extension of the Notion of Solubility to Colloids. Jacques Duclaux (*Compt. rend.*, 1909, **148**, 295—297).—Colloidal solutions can be concentrated by filtering out the solvent under pressure through collodion. An increasing pressure will remove more and more solvent, until a limit is attained where the colloid solidifies. This limiting pressure is termed the "maximum osmotic pressure" of the colloid, and the limiting concentration the "solubility" of the colloid.

The solubility so defined of gelatin is about four parts in one hundred of water, of gelose less than one in one hundred, and of some kinds of ferric oxide more than sixty in one hundred of water. The osmotic pressure of Bredig's colloidal platinum is less than 20 mm. of water, whereas that of ferric hydroxide is more than 20 metres of water.

The author proposes to employ this conception of solubility in defining the relative stability of various colloids, in describing the modifications of a colloid through added substances, etc., and also in separating colloids from one another as salts are crystallised.

Experiment has shown that the solubility of a colloid is very closely related to the size, composition, and electric charge of the molecular clusters which compose it. R. J. C.

Theory of Reversible Sols. H. Waldemar Fischer and O. Bobertag (*Jahrsb. Schles. Ges. vaterländ Cult. Naturwiss. Sek.*, 1908, Reprint 1—15. Compare Abstr., 1908, ii, 1024).—For the study of reversible colloids it is necessary to have as a standard substance one which is perfectly free from electrolytes, is a simple chemical substance of known constitution having a minimum reactive power, of great stability, and of high molecular weight. It is found that myricyl alcohol, $C_{30}H_{61}\cdot OH$, and the paraffin, $C_{60}H_{122}$, prepared therefrom sufficiently fulfil these requirements.

The behaviour of myricyl alcohol towards chloroform, amyl alcohol, ether, alcohol, and benzene is practically identical, it being almost insoluble in the cold, the solubility increasing rapidly with rise of temperature.

A hot saturated solution when suddenly cooled changes to a semi-solid, gelatinous mass. The temperature at which gelatinisation takes place is to a great measure dependent on the concentration of the solution; a critical point is reached as in the case of two incompletely miscible liquids.

From this it follows that the concentration of the Gels varies with the temperature, and, therefore, the chloroform, etc., that is present is neither as chloroform of crystallisation or in molecular combination, nor is it simply absorbed. When a 0·01% ethereal solution of myricyl alcohol is suddenly cooled to −60°, a reversible sol is obtained, an opalescent liquid from which a drop of cold alcoholic solution of carbon dioxide causes a flocculent precipitation.

Smaller values are obtained for the solubility of myricyl alcohol in chloroform and amyl alcohol when the temperature is increased than when the temperature is decreased. If very slowly cooled, myricyl alcohol separates from solution in small, rhombic crystals, which readily lose the chloroform when exposed to the air. J. V. E.

Apparent Colloidal Diffusion. Porosity of Collodion Membranes. Raphael E. Liesegang (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 62—63).—A case of apparent diffusion of colloidal silver chloride is described. A silver chloride-collodion emulsion, which had been prepared from silver nitrate and lithium chloride and contained a very slight excess of lithium chloride, was spread in a thin layer on a glass plate and dried at the ordinary temperature. The silver chloride was distributed through the layer of collodion in a finely divided granular condition. After some weeks the silver chloride was found to have become quite coarse-grained and non-transparent, and instead of being uniformly distributed through the collodion, it was now found to lie entirely on the surface of the collodion membrane. This apparent diffusion of the colloid is attributed to the solvent action of the small excess of lithium chloride on the silver chloride. The collodion film is supposed to exert a pressure on the salts present, and silver chloride separates on the surface. The lithium chloride thus set free dissolves more of the fine-grained silver salt in the interior, and further separation of the dissolved colloid takes place at the surface.

Unsuccessful attempts to obtain partly porous collodion films are described. H. M. D.

Freezing of Jellies. Giuseppe Bruni (*Ber.*, 1909, 42, 563—565).—The results obtained by Lottermoser (this vol., ii, 27) confirm those published by the author some time ago (*Rend. Soc. chim. Roma*, 1905, 3, 1). Analyses of the crystalline substance obtained by freezing the gel of silicic acid show that its composition is not definite, but lies between $SiO_2,0·788H_2O$ and $SiO_2,3·67H_2O$. A constant relationship between the quantity of water in the hydrogel and in the crystalline silicic acid could not be discovered. W. H. G.

Mechanism of Agglutination. Leonor Michaelis (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 55).—The author points out that Loebs' view (*ibid.*, 1908, 3, 113) of the process of agglutination involves the conclusion that the surface tension not only diminishes, but, indeed. becomes negative; this is contradictory to the generally accepted view that coagulation phenomena are accompanied by a diminution of the total surface. Loeb's observations can be explained quite readily in terms of the latter view. H. M. D.

Passivity in Acid Solutions. OTTO SACKUR [with J. ALVARES] (*Zeitsch. Elektrochem.*, 1908, 14, 607—613).—A current is passed through a cell containing a nickel anode immersed in sulphuric acid and a copper cathode in copper sulphate contained in a porous pot. With small currents, the *E.M.F.* at the terminals of the cell is proportional to the current; when a certain current strength is exceeded, the *E.M.F.* rises suddenly, indicating that the nickel has become passive. The critical current is approximately proportional to the area of the anode and to the concentration of the hydrogen ions in the solution. It increases rapidly with the temperature, and with the quantity of halogen ion in solution. The nickel is dissolved quantitatively below the critical current density, but, above it, small quantities still go into solution. It is shown that the current density which would be sufficient to reduce the concentration of the hydrogen ions at the surface of the anode to 10^{-7}, and so permit of the separation of nickel hydroxide, is very much smaller than the critical current density observed. The explanation of passivity by the formation of an insoluble skin of hydroxide is therefore rejected. T. E.

Passivity in Acid Solutions. II. J. ALVARES (*Zeitsch. Elektrochem.*, 1909, 15, 142—144).—Iron is investigated in the same way as nickel (preceding abstract). The critical current is higher when the anode is rotated than when it is at rest; it increases with the concentration of the sulphuric acid to a maximum (at $1N$-H_2SO_4) and then diminishes again. The addition of halogen ions makes no difference to the critical current; a rise of temperature increases it. In the active condition the iron is covered with a black skin, which disappears when it becomes passive, the metal assuming a matt, metallic appearance.

The critical current for chromium increases continuously with the strength of the acid, as is the case with nickel; chromium also becomes passive in hydrochloric acid. In the active state the chromium dissolves as the green chromic ion, whereas in the passive state it dissolves as chromic acid. T. E.

Formation of Esters. ANTON KAILAN (*Zeitsch. Elektrochem.*, 1909, 15, 106—110). RUDOLF WEGSCHEIDER (*ibid.*, 111).—Polemical papers referring to a criticism of Kailan's work by Goldschmidt (this vol., ii, 129). T. E.

Atomic Weights. JULIEN DELAUNEY and MAURICE GARNIER (*Mon. Sci.*, 1909, [iv], 23, 27).—An attempt to deduce a connexion between the atomic weights of related elements. H. M. D.

Forms of Matter. II (continued). P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 123—139. Compare this vol., ii, 132, 221).—The absence of precipitation on the addition of a dilute solution of aluminium chloride to concentrated ammonia solutions is not always due to the formation of a true solution, but is determined by the formation of a hydrosol. Such a hydrosol results as a consequence of the peptisation of the very finely divided precipitate of aluminium hydroxide. The conditions for the formation of the aluminium hydroxide hydrosol in ammonia solutions are discussed in detail. There are two limiting concentrations below and above which the peptisation does not occur, and an intermediate concentration for which the hydrosol formation reaches a maximum.

Other special cases are considered, and the author then gives the general conditions which are necessary and sufficient for the occurrence of peptisation phenomena. These conditions differ somewhat from those given by Lottermoser (compare Abstr., 1907, ii, 851).

Although barium sulphate and aluminium hydroxide have been examined in very great detail, numerous observations have been made on the precipitation phenomena in the case of a very large number of other insoluble substances. A list of substances which have been obtained in all possible forms of fine-grained, crystalline (so-called colloidal amorphous) precipitates is given. For the investigation in any particular case of the influence of concentration on the nature and structure of the precipitated substance, it is necessary that the product VC should be kept constant in the experiments, V being the volume of the solution and C its concentration.

From a consideration of the factors which determine the nature of the crystallisation process, it is shown that the order of magnitude of the solubility of a substance can be ascertained from the form of the precipitate, which is obtained under given conditions. H. M. D.

Apparatus for Rapidly Obtaining a Stream of Water at Constant Temperature for Refractometers and Polarimeters. Von Heygendorff (*Chem. Zeit.*, 1909, 33, 244).—A reservoir of about one litre capacity is fitted with an outlet at the bottom and an overflow tube which can be readily adjusted so as to maintain any required constant head of water. By this means a constant flow of water from the outlet is made to pass through a copper coil heated by a Bunsen burner to the temperature necessary to raise the temperature of the outflowing water to that required. The adjustment of the water flowing into the reservoir keeps the head of water constant, and by raising or lowering the waste tube the water may be caused to flow through the hot copper coil at a more rapid or a less rapid rate, thus decreasing or increasing the temperature. With this arrangement it is possible to maintain a current of water through jacketed tubes, etc., at temperatures between 20—40° by using an ordinary Bunsen burner. J. V. E.

New Forms of Condenser. H. Stoltzenberg (*Zeitsch. angew. Chem.*, 1909, 22, 351. Compare Abstr., 1908, ii, 938).—A double cylinder condenser, Fig. 1, and a spiral condenser with water-jacket, Fig. 2, have been devised so as to present maximum cooling surface, and have the advantage of being readily detachable for cleaning. They are modifications of those described previously by the same author.

J. V. E.

FIG. 1.

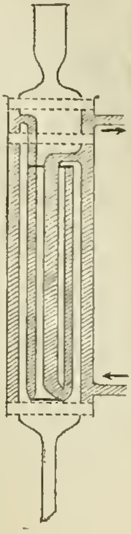
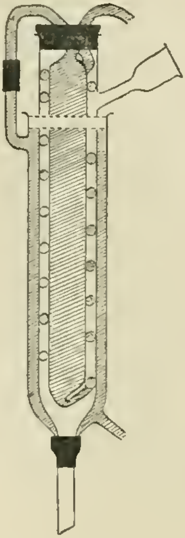


FIG. 2.



An Apparatus for Decanting and Filtering. J. HUDIG (*Chem. News*, 1909, **99**, 112—113; *Chem. Zeit.*, 1909, **33**, 298—299).—The apparatus described and figured in detail consists of a horizontal shaft fixed rigidly on a stand; on this shaft rotate several holders made of wood, each carrying an adjustable spring clamp to hold a flask. Besides this spring-clip each holder is fitted with a clamping spring for the purpose of attaching a glass rod to serve as a guide for the outflowing liquid. At the side of each holder a wooden cog-wheel is fitted which engages with a worm spindle moving in a guide that is rigidly fixed to the shaft. The worm spindle can be clamped by means of a small nut. A flask may therefore be held in any desired position or may be slowly tipped by turning the worm spindle by means of a milled head.

By means of this arrangement the operation of washing a precipitate by decantation and finally transferring it to a filter may be considerably facilitated and hastened. It is claimed for this method that the fluid may be decanted absolutely free from precipitate; the filter may be kept constantly filled; the precipitate may be completely washed; and several filtrations may be simultaneously effected.

J. V. E.

Demonstration of the Expansions of Gases and Vapours. H. REBENSTORFF (*Zeitsch. physikal.-chem. Unterr.*, 1908, **21**, 378—383).—A series of experiments, illustrated by figures of the apparatus, employed in demonstrating the alteration in the volumes of gases and vapours as induced by changes of pressure.

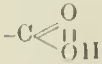
G. T. M.

Supercooling of Water. V. KUMMERELL (*Zeitsch. physikal.-chem. Unterr.*, 1908, **21**, 391).—A basin containing ether is placed on a layer of water, and as the ether evaporates, a stage is reached when the evaporating liquid froths up suddenly in a manner quite distinct from its superficial evaporation. This phenomenon is due to the supercooling of the underlying water, which finally freezes, generating a considerable amount of heat, and thus causing the more rapid frothing up of the ether. At this point the basin is found to be frozen to the moistened surface. G. T. M.

A Demonstration of Atmospheric Humidity and Cold produced by Evaporation. H. STROMAN (*Zeitsch. physikal.-chem. Unterr.*, 1908, 21, 390—391).—Two small Erlenmeyer flasks, one containing a little water and the other a similar amount of concentrated sulphuric acid, are each fitted tightly with a cork carrying a test-tube in which ether is placed. A stream of ordinary air is blown through the two test-tubes so that the ether evaporates. The tube over water becomes encrusted on its exterior with ice, whilst the tube over the strong acid remains unchanged. The interiors of the tubes leading in the air current will both become encrusted with ice, showing the humidity of ordinary atmospheric air. G. T. M.

A Lecture Demonstration of Lime-burning. KARL SCHEID (*Zeitsch. physikal.-chem. Unterr.*, 1908, 21, 393—394).—A steel or platinum tube with an obliquely truncated closed end is used for heating various forms of calcium carbonate. When the open end is fitted with a glass tubulure, a large amount of carbon dioxide can be quickly collected and tested. The inverse change can be observed by connecting the tube with a manometer and gently heating the platinum tube with a very small flame, when the recombination of the gas with the residue is readily indicated. G. T. M.

Inorganic Chemistry.

Quadrivalency of Oxygen. H. STANLEY REDGROVE (*Chem. News*, 1909, 99, 109—110. Compare Abstr., 1908, ii, 564).—The recent work of Miss Smedley on the constitution of the carboxyl group (Trans., 1909, 95, 231), the formulation of which is considered to be , has prompted the author to consider this question in the light of its thermo-chemical properties. Arguments for and against this constitution of the carboxyl group are given, in which it is assumed that when oxygen becomes quadrivalent the thermal value of the two primary valencies remains unaltered. It is, however, far more probable that when oxygen functions as a quadrivalent atom the thermal value of its two primary valencies will be decreased. If this be so, all the arguments from the thermal point of view in support of the above formulation entirely break down. From the thermal data available, the conclusion is drawn that the quadrivalent oxygen formula for the carboxyl group cannot be justified. J. V. E.

Concentration of Hydrogen Ions in Sea-Water. Wilhelm E. Ringer (*Chem. Weekblad*, 1909, 6, 113—123. Compare Ringer and Klingen, Abstr., 1908, ii, 320; Salm and Friedenthal, Abstr., 1907, ii, 389; Neumann, Abstr., 1894, ii, 373; Smale, Abstr., 1894, ii, 436; Bose, Abstr., 1900, ii, 704; 1901, ii, 589; 1902, ii, 58; Wilsmore, Abstr., 1901, ii, 2, 142; Coggeshall, Abstr., 1895, ii, 377; Richards, Abstr., 1898, ii, 7; Jahn, Abstr., 1900, ii, 522; Sauer, Abstr., 1904, ii, 307; Palmaer, Abstr., 1907, ii, 424; Abegg and Bose, Abstr., 1900, ii, 127; Sackur, Abstr., 1902, ii, 121; Tower, Abstr., 1896, ii, 142).—Reference is made to the work of the authors cited, and the results of a number of determinations of the concentration of the hydrogen ions in various parts of the North Sea are given. C_H varies between 0·58 and $1·40 \times 10^{-8}$. The water is slightly alkaline, and there is not any appreciable difference between samples from the northern and southern parts of the ocean. In those from Bömmelfiord the acidity increases with the depth and with increase in the percentages of salts and carbon dioxide. No definite relation between the percentage of salts and the concentration of hydrogen ions was observed. It is possible that increase in acidity is associated with fall in temperature. A. J. W.

The Molecular Magnitude of Sulphur in Bromoform Solution. Alessandro Borgo and M. Amadori (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 138—141. Compare Paternò, this vol., ii, 118).—Sulphur in bromoform solution gives cryoscopic results corresponding very exactly with the formula S_8.

Pure bromoform, distilled in a vacuum and repeatedly frozen, is best preserved in the solid state in the dark, being thawed immediately before use. C. H. D.

Equilibrium in the System Colloidal Sulphur–Solution of Crystalloid. The Svedberg (*Zeitsch. Chem. Ind. Kolloide.*, 1909, 4, 49—54).—Colloidal sulphur was prepared by slowly adding a concentrated solution of sodium thiosulphate to concentrated sulphuric acid, the temperature not being allowed to rise above 25°; after the addition of water, the mixture was washed, filtered, and the resulting solution precipitated by addition of sodium chloride; the separated sulphur was then decanted, centrifuged, dissolved in water, and again precipitated, these operations being repeated until the sulphur was quite free from sulphate.

The solubility of this colloidal sulphur in 0·2, 0·3, 0·4, and 0·5 molar sodium chloride, 0·2 molar sodium bromide, and 0·2 molar sodium sulphate solutions was measured for a series of temperatures. In all cases the variation of the solubility (c) with the temperature (t) is given by the equation $\log c = k.t$, in which k is a function of the concentration of the dissolved crystalloid. For equimolar solutions, k appears to be independent of the anion of the dissolved electrolyte. H. M. D.

The Absorption of Sulphur Dioxide in Water. W. Fulda (*Arb. Kais. Gesund. Amt.*, 1909, 30, 81—86).—A theoretical paper dealing with the deviation from Henry's law of the solubility of sulphur dioxide in water, as determined by earlier investigators.

S. B. S.

Pyrosulphuryl Chloride, $S_2O_5Cl_2$. WILHELM PRANDTL and PAUL BORINSKI (*Zeitsch. anorg. Chem.*, 1909, 62, 24—33).—The pyrosulphuryl chloride described by previous observers, with the exception of Konowaloff (Abstr., 1883, 553, 782, 900), has been a mixture containing sulphuryl hydroxychloride, $SO_2Cl\cdot OH$. The pure compound, prepared by the action of sulphur trioxide on carbon tetrachloride, the crude product being repeatedly subjected to very slow fractional distillation, boils at 150·7°/730 mm. The presence of the hydroxyl compound in most preparations is due to the presence of some sulphuric acid in the sulphur trioxide used. The crude product is best purified by the cautious addition of ice, which decomposes the sulphuryl hydroxychloride rapidly, the lower layer, which may be separated, then consisting of nearly pure pyrosulphuryl chloride, D^0 1·876, D^{18} 1·844. The vapour density at 205° is normal, moisture being excluded.

Pyrosulphuryl chloride reacts very slowly with water. In moist air it becomes turbid, owing to the separation of drops of sulphuric acid, which disappear on warming and reappear on cooling.

C. H. D.

Catalytic Oxidation of Hypophosphorous Acid by Copper. J. BOUGAULT (*Compt. rend.*, 1909, 148, 415—417).—On adding a solution of sodium hypophosphite to a large excess of copper sulphate, a brownish-yellow precipitate is formed, which, on boiling, is gradually converted into a well-crystallised powder, consisting of extremely pure copper. If, however, excess of hypophosphite is used, a granular, brown precipitate, probably Würtz's hydride, Cu_2H_2, is obtained, which, on heating, gives a large volume of hydrogen and a frothy, reddish-brown precipitate of copper. This precipitate has a very powerful catalytic action on solutions of sodium hypophosphite, whereby hydrogen is evolved, and the hypophosphite becomes oxidised into phosphite and phosphate. The action is stopped by the accumulation of acidic products, but on neutralising the liquid or taking a fresh portion of hypophosphite, more hydrogen can be obtained.

By placing 0·35 gram of the copper powder in four solutions of hypophosphite successively, 4 litres of hydrogen were obtained.

Copper precipitated by zinc has a similar, but much feebler, catalytic activity.

R. J. C.

[Preparation of Colloidal Arsenic.] CHEMISCHE FABRIK VON FRIEDR. HEYDEN (D.R.-P. 202561).—A stable colloidal solution of arsenic may be obtained by reducing its compound in an alkaline medium in the presence of a protective colloid. White arsenic dissolved in aqueous sodium hydroxide containing some protein material, such as white of egg, lysalbic acid or gelatin, is reduced by alkaline pyrogallol. The solution is dialysed or the colloidal arsenic precipitated by acid, washed, and again dissolved in water. The colloidal arsenic may be precipitated from solution by acetone, alcohol, or a mixture of the latter with ether. On evaporating the solution, it is obtained in black, lustrous lamellæ, which dissolve in water to a deep brown solution. G. T. M.

The Growth of Quartz Crystals. Giorgio Spezia (*Atti R. Accad. Sci. Torino,* 1909, **44**, 95—107).—Quartz hexagonal prisms, cut from crystals in directions perpendicular to the axes, were suspended in heated solutions of sodium silicate in which fragments of quartz were placed. Each experiment lasted several months, the temperature being as high as 340° in the neighbourhood of the solution. Sodium chloride in the solution modifies the growth, causing greater limpidity, striations on the prism faces, and a different development of the rhombohedral faces. The greatest growth takes place when the principal axis of the prism is vertical, that is to say, parallel with the diffusion currents. C. H. D.

Thermal Effects of the Musical Arc. [Probable Crystallisation of Carbon.] La Rosa (*Compt. rend.*, 1909, **148**, 616—617).—By a suitable modification of the experimental arrangement previously described (*ibid.*, 475), the author has obtained from sugar carbon, transparent, crystalline particles, which fall in bromoform and methylene iodide, and are sufficiently hard to scratch a ruby.
H. M. D.

Combustion of Gases without Flame and the Conditions in Incandescent Lighting. Jean Meunier (*Compt. rend.*, 1909, **148**, 292—294. Compare this vol., ii, 463).—A platinum wire was substituted for the fork and mantle of an ordinary Welsbach burner with a glass chimney, and by careful manipulation of the gas supply the platinum could be maintained in incandescence, although there was no flame at the burner or the wire. Local combustion could thus go on at the surface of the wire, although the whole chimney was filled with an explosive mixture, but a sudden disturbance of the gas supply or outer air caused the burner to light up with a mild explosion. Combustion of gases without flame is similar to the combustion of solids like carbon, being attended by a convergence of molecules to the ignition point. R. J. C.

Argon in Association with Radioactive Zirconium Minerals. Andreas von Antropoff (*Zeitsch. Elektrochem.*, 1909, **15**, 144—145).—O. Hahn suggests (*ibid.*, 50) that the argon found in a zirconium mineral (Abstr., 1908, ii, 943) was derived from the atmosphere. The author states that the quantity was far larger than could be accounted for in this way. T. E.

Some Corroded Metals. Willem P. Jorissen (*Chem. Weekblad,* 1909, **6**, 150—153).—An account of the corrosive action of light and air on certain metals and alloys. A. J. W.

Laboratory Preparation of Sodium or Potassium Hydroxide Free from Carbonate. Willem P. Jorissen and H. Filippo, jun. (*Chem. Weekblad*, 1909, **6**, 145—149).—The authors describe a method of preparing sodium or potassium hydroxide free from carbonate by a modification of the Castner-Kellner process, using a mercury cathode in a solution of the crude hydroxide. The amalgam formed is decomposed by water. A. J. W.

Theory of the Bell-Chamber Process. André Brochet (*Bull. Soc. chim.*, 1909, [iv], 5, 202—207. Compare Abstr., 1908, ii, 1034).—A critical discussion of the causes of the divergence in the views of the author and of Chancel (this vol., ii, 235) as regards this process, is given. T. A. H.

Potassium Perborates. Conway von Girsewald and A. Wolokitin (*Ber.*, 1909, 42, 865—869).—The authors have prepared two *potassium perborates* having the formulæ $2KBO_3,H_2O$ and

$$2KBO_3,H_2O_2.$$

The former is obtained by adding 100 c.c. of a cold 75% solution of potassium metaborate, KBO_2, to 1020 c.c. of a cold 3% solution of hydrogen peroxide. After some hours the liquid is filtered and the perborate precipitated by adding 900 c.c. of methyl alcohol. The salt is collected after twelve hours and washed with ice-cold water. It is a microcrystalline powder, of which 1·25 parts are dissolved by 100 parts of water at 0° and 2·5 parts at 15°. The salt is stable when dry, but an aqueous solution loses its active oxygen at 50° in an hour and more slowly at lower temperatures.

The second salt, $2KBO_3,H_2O_2$, is obtained by the same process, but using 30% hydrogen peroxide. It is a fine, white powder, which is stable at the ordinary temperature. When rapidly heated it deflagrates at 150—160°, but when heated slowly, the active oxygen is quantitatively evolved. One hundred parts of water dissolve 0·70 part at 15°. Both salts have considerably stronger antiseptic properties than either boric acid or potassium chlorate. J. C. C.

[Preparation of Persulphates.] Vereinigte Chemische Werke (D.R.-P. 205067, 205068, and 205069).—It has been found that the yield of persulphate is considerably increased when simple or double cyanides are added to the sulphate solution in the electrolytic cell. A cold concentrated solution of sodium hydrogen sulphate containing a small proportion of potassium ferricyanide was electrolysed with a current of anode density of 0·167 ampere per sq. cm. The yield was maintained by the addition of further quantities of ferricyanide, and after thirty-six ampere hours a total yield of 84% of persulphate was obtained. Alkali cyanates, thiocyanates, and cyanamides produce a similar effect. The sodium persulphate obtained in this way separates from the concentrated solution as a sludge-like precipitate, which is purified only with difficulty. A granular form of sodium persulphate is, however, obtained when a small amount of a potassium salt, particularly a cyanide derivative, is introduced into the electrolytic solution. G. T. M.

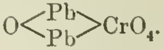
Chemical Composition of Colloidal Silver Produced Electrically. G. Rebière (*Compt. rend.*, 1909, 148, 354—357).—Colloidal solutions of the noble metals have a conductivity much greater than that of the water they are prepared from, but insufficient to be attributed to metallic conduction. The explanation suggested by Blake in the particular case of silver, that soluble silver oxide is the conducting agent, is now confirmed. On precipitating colloidal silver with an electrolyte (barium nitrate), a minute amount of silver remains in solution, which is roughly proportional to the original conductivity. If a small current is passed between silver poles under water, the colloidal solution obtained is brown, and has a low conductivity. As larger currents are employed, the colloid particles tend to increase in size, so that the solutions may be greenish or bright green. In these cases there is more electrolysis of the water, and hence more formation of silver oxide. In general, the conductivity of green colloidal silver is much greater than that of brown. The addition of an electrolyte to brown colloidal silver first produces a change of colour to green, and then a further agglutination of the granules into a flocculent precipitate.

Soluble silver oxide, often considerable in amount, may greatly influence the properties of colloidal silver, particularly its biological action. R. J. C.

Lead Chromate. EDWARD E. FREE (*J. Physical Chem.*, 1909, **13**, 114—137).—Solutions of lead nitrate of concentrations varying from molar to 1/16,384 molar were mixed with solutions of potassium chromate of corresponding strength at intervals of temperature between 20 and 90°, and the colour of the precipitate and average size of the crystals examined. The mixing was effected by adding one solution slowly to the other with rapid stirring, but under corresponding conditions the same results were not always obtained. The largest crystals are obtained in dilute and hot solution, but the depth of colour is greatest for solutions of intermediate concentration (1/8—1/32 molar). It follows that the depth of colour depends on factors other than the size of the crystals, probably on the basicity of the salt. As a chrome-yellow formed of small crystals possesses the clearer colour and greater covering power, the proper conditions for the manufacture of chrome-yellow are rapid mixing of cold and concentrated solutions under conditions which most successfully prevent the formation of basic salt. What the latter conditions are has not been determined. Glue retards precipitation and causes the formation of smaller crystals. G. S.

Lead Chromate and its Change of Colour. CASIMIR JABŁCZYNSKI (*Chem. Ind.*, 1908, **31**, 731—733).—Freshly precipitated yellow lead chromate becomes orange after a short time and loses its lustre. This is prevented technically by the addition of lead sulphate. The nature of the change, and of the protective action, have been investigated.

Precipitation of potassium chromate with an excess of lead acetate gives a yellow product, which does not change colour in contact with the solution, even on boiling, but becomes orange if filtered. Acetic acid does not exert a protecting influence. When basic lead acetate is used, the yellow precipitate always becomes red in time, losing water to form the basic salt,



$O\begin{matrix}\diagup Pb \diagdown \\ \diagdown Pb \diagup\end{matrix}CrO_4$.

The presence of 10% of lead sulphate in the precipitate prevents the change, even if the two solids are only mechanically mixed after precipitation. It has no effect on basic lead chromate. Barium sulphate and lead phosphate are without influence. The conclusion is drawn that the presence of a soluble lead salt is necessary, and that the lead ions act by reducing the hydrolysis of the chromate, the change of colour of which is due to the formation of the basic salt.

Besides this irreversible change, a reversible change of colour is observed, the colour of the precipitate being deepened on boiling with water, but returning to its original shade on cooling. C. H. D.

Electrolysis of Copper Solutions. JEAN MEYER (*Zeitsch. Elektrochem.*, 1909, **15**, 12—20, 65—73).—The addition of hydrogen peroxide to the acid copper sulphate solution of a copper voltameter diminishes the quantity of copper deposited. When a hot neutral solution of copper sulphate is electrolysed, in an atmosphere of hydrogen or carbon dioxide, with a small current density, cuprous oxide alone is deposited on the cathode; four farads yielding approximately one gram-molecule of it or about one-half the theoretically possible amount. The quantity of cuprous oxide formed is estimated by treating the cathode with a neutral solution of iron alum and titrating the ferrous sulphate produced by the reactions $Cu + Fe_2(SO_4)_3 = CuSO_4 + 2FeSO_4$ and $Cu_2O + Fe_2(SO_4)_3 = CuSO_4 + CuO + 2FeSO_4$. From the loss of weight of the cathode and the quantity of ferrous salt produced, the quantity of cuprous oxide is easily calculated.

When copper is warmed with neutral copper sulphate solution, cuprous oxide and a green basic cupric salt are formed, the quantity of the former is always less than equivalent to the quantity of copper dissolved. The reactions occurring are probably $Cu + CuSO_4 + H_2O = Cu_2O + H_2SO_4$ and $Cu_2O + CuSO_4 + H_2O = Cu_2SO_4 + Cu(OH)_2$. The basic salt is formed even when air is excluded.

The greater part of the paper consists of criticisms of Foerster's views of the electrolytic reduction of cupric to cuprous ions and the formation of cuprous oxide by hydrolysis of cuprous sulphate (Abstr., 1897, ii, 241; 1904, ii, 818). The author considers that copper is always deposited primarily, and that it then reacts with cupric sulphate, thus: $Cu + CuSO_4 + H_2O = Cu_2O + H_2SO_4$. T. E.

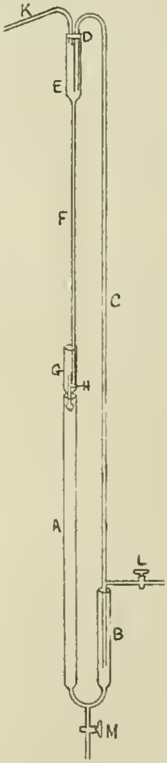
Electrolysis of Copper Sulphate. FRITZ FOERSTER (*Zeitsch. Electrochem.*, 1909, **15**, 73—76).—Meyer's explanation of the cathodic formation of cuprous oxide (preceding abstract) is equivalent to the two reactions: $Cu + CuSO_4 \rightleftharpoons Cu_2SO_4$ and $Cu_2SO_4 + H_2O \rightleftharpoons Cu_2O + H_2SO_4$, that is, he supposes the cuprous salt to be a secondary product, whereas Foerster regards it as a primary product formed by the removal of one electron from a cupric ion.

The author has confirmed Luther's observation of the reduction of permanganate by a solution of cupric sulphate which has been boiled with copper (Abstr., 1901, ii, 301), a reaction which Meyer failed to obtain. T. E.

Equilibrium between Cuprous and Cupric Chlorides in Hydrochloric Acid Solution. G. Poma (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 133—138).—Cuprous chloride dissolves in a solution of cupric chloride in hydrochloric acid, forming a brown solution, from which water re-precipitates cuprous chloride. The solubility of cuprous chloride in solutions containing the same amount of hydrochloric acid is approximately proportional to the concentration of the cupric chloride, the proportionality being best seen in strongly acid ($4N$) solutions. The results indicate the formation of cuprous-cupric salts. C. H. D.

Constitution of the Cuproso-cupric Chloro-salts. G. Poma (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 192—197. Compare preceding abstract).—The specific conductivity of a $3N$-solution of hydrochloric acid is not notably altered by the addition of cupric or cuprous chloride, or both. By measuring the oxidation and reduction potentials at an electrode of platinised platinum in such a solution, it is found that as the concentration of cupric chloride is increased, that of cuprous copper increases enormously, whilst the number of cuprous ions in the solution shows only a very small increase, indicating that the cuprous copper is present in a complex ion, the cupric copper being free. Transport experiments show that the brown substance travels to the anode, the liquid round the cathode becoming green. The complex anion probably contains Cu^{II} as well as Cu^{I}. The investigation is being continued. C. H. D.

An Apparatus for the Purification of Mercury. L. Junius Desha (*Amer. Chem. J.*, 1909, 41, 152—155).—The form of the apparatus, which, with the exception of the india-rubber stopper *D*, is entirely of glass, will be understood from the diagram. The tube *A* is 22 mm. in diameter and 90 cm. long; *B* is 35 cm. long and of the same diameter; *C* and *F* are of thick-walled capillary tubing 1·5 mm. in bore; *C* is 200 cm. long, and *F*, 76 cm. long; *E* is 20 mm. in diameter and 15 cm. long. Into the bottom of the mercury trap, *G*, a capillary tube, *H*, the lower end of which is blown into a small bulb pierced with several very small holes, is fused. The action of the apparatus is as follows. Mercury, sufficient (or excess) to cover the lower end of the tube *C*, is poured into *B*, and the remainder of *A* is filled with 1% nitric acid. After filling the mercury trap *G* with mercury, *K* is connected to a suction pump, and the stopcock, *L*, is adjusted so that alternate small portions of mercury and air are drawn up the tube *C* into *E*. Mercury is, of course, simultaneously drawn up into *F* to



balance that in *C*. The mercury so transferred to *E* gradually falls into the trap *G*, and thence through the fine holes in the lower end of the tube *H* into the column of dilute nitric acid in *A*.

The apparatus is obviously quite automatic, and the mercury can be passed through the cleansing solution any desired number of times by leaving the apparatus working a sufficient length of time.

E. H.

Copper Complexes in Ammoniacal Solution. HARRY M. DAWSON (*Ber.*, 1909, **42**, 720—726. Compare Trans., 1900, **77**, 1239; Hantzsch and Robertson, this vol., ii, 44).—The copper tetrammine complex, $Cu(NH_3)_4$, is shown not to be so stable as Hantzsch and Robertson imagine, and the author, whilst admitting that the spectrophotometric method of these authors is satisfactory for the examination of ammoniacal copper solutions rich in ammonia, claims that his partition-coefficient method is simpler and gives more accurate results for solutions in which the concentration of the ammonia is relatively small.

C. S.

Double Salts of Mercuric Iodide. ANDRÉ DUBOIN (*Ann. Chim. Phys.*, 1909, [viii], **16**, 258—288).—A résumé of work already published (compare Abstr., 1905, ii, 637; 1906, ii, 85, 231, 286, 359, 544, 673; 1907. ii, 955; 1908, ii, 598). A second *thorium mercuric iodide*, $ThI_4,2HgI_2,12H_2O$, is described.

M. A. W.

Revision of the Atomic Weights of the Rare Earths. GEORGES URBAIN (*Bull. Soc. chim.*, 1909, [iv], **5**, 133—172).—This paper forms Urbain's contribution to the work of the "International Committee on Atomic Weights," and gives a résumé of the data on which the 1909 "International Atomic Weights" for the following elements are based, namely, cerium, dysprosium, erbium, europium, gadolinium, lanthanum, lutecium, neodymium, ytterbium (neoytterbium), praseodymium, samarium, scandium, terbium, thulium, yttrium. It is also pointed out that holmium probably has an atomic weight between 162·5 and 167, but that the homogeneity of this substance is not yet satisfactorily established.

T. A. H.

Thermal Phenomena which Accompany the Action of Water on Aluminium Powder. ÉMILE KOHN-ABREST and J. CARVALLO (*Compt. rend.*, 1909, **148**, 410—413).—The oxidation of aluminium powder by water is accompanied by an evolution of 45,000 cal. per gram-atom of aluminium, and subsequently by a slow absorption of heat as the oxide becomes hydrated. The grains in the resulting powder contain 23·1% of water and a core of unoxidised aluminium. The estimation of water is found to be complicated by the fact that oxidation takes place on heating, and a measurable amount of hydrogen is evolved.

The ratio of oxygen to combined aluminium is somewhat less than that required by the formula Al_2O_3, whence the conclusion is drawn that a lower oxide is present. Confirmation is found in the fact that the hydrogen evolved by the action of hydrochloric acid on the powder is more than equivalent to the ferric sulphate the powder can reduce.

R. J. C.

Examination of an Old Devitrified Glass which had become Violet in Colour under the Influence of Solar Radiation. Delachanal (*Compt. rend.*, 1909, **148**, 639—640).—When heated to a temperature corresponding with complete fusion, 100 grams of the glass evolved about 70 c.c. of gas, most of which was absorbed by a solution of potash, the small remainder consisting of oxygen and nitrogen. A crystalline sublimate which was obtained consisted chiefly of sodium chloride with smaller quantities of potassium sulphate, arsenious oxide, and sodium sulphate. H. M. D.

Solubility of Manganese Sulphate in Mixtures of Water and Alcohol. Frans A. H. Schreinemakers (*Chem. Weekblad*, 1909, **6**. 136—139. Compare Cuno, Abstr., 1908, ii, 160).—The solubility of manganese sulphate in mixtures of water and alcohol in various proportions has been determined at 25° and 50°, and tables showing the percentages of water, alcohol, and manganese sulphate in the solutions are given. A. J. W.

Double Salts of Ammonium Sulphate and Manganese Sulphate. Frans A. H. Schreinemakers (*Chem. Weekblad*, 1909, **6**, 131—136. Compare Cottrell, Abstr., 1901, ii, 12).—At 25° the following double salts of ammonium and manganese have been isolated; $2MnSO_4,(NH_4)_2SO_4,11H_2O$; $MnSO_4,(NH_4)_2SO_4,6H_2O$; $MnSO_4,2(NH_4)_2SO_4,6H_2O$. At 50°, the following have been isolated: $3MnSO_4,(NH_4)_2SO_4,H_2O$; $2MnSO_4,(NH_4)_2SO_4$; $MnSO_4,(NH_4)_2SO_4,\frac{1}{2}H_2O$.

A. J. W.

The Hardening and Tempering of Iron and Steel. Ed. Maurer (*Metallurgie*, 1909, **6**, 33—52).—The hardness of steel quenched from 800° is only slightly altered by heating until nearly 400°, when a rapid fall takes place. Pure austenite (Abstr., 1908, ii, 489) is little harder than annealed iron; its hardness is increased by heating to 400°, owing to its conversion into martensite. Above this temperature it behaves like other hardened steels. The curves of remanent magnetism show a marked maximum at 450°. Pure austenite shows a large increase of magnetism when heated to 450° or when cooled in liquid air.

The electrical resistance falls with increasing tempering temperature, becoming constant after 300°. The changes in resistance, unlike those in the other physical properties, are due to the hardening carbon, as is shown by experiments with pure iron.

The thermal and microscopic examination shows that γ-iron may occur in hypoeutectoid steels if the quenching temperature is not below 1000°. It is also produced by mechanical deformation in the cold.

The hardness is not due to carbon, but to the presence of allotropic forms of iron. A hypothetical explanation of all the facts is proposed, based on the formation of solid solutions of the different modifications of iron, with and without carbon. C. H. D,

The Precipitation of Nickel Sulphide from Aqueous Solutions. Alfred Thiel and H. Ohl (*Zeitsch. anorg. Chem.*, 1909, **61**, 396—412).—The addition of ammonium sulphide to dilute solutions of nickel salts only produces a brown coloration after an interval. The effect is not due to supersaturation. The velocity of precipitation increases with the concentration of the reacting substances and with the temperature. Both ammonia and acids delay the precipitation.

It is assumed that the first product of the reaction is the simple sulphide, NiS. A precipitate is only produced immediately when the solubility product for NiS is exceeded. In other cases the NiS remains in solution, slowly polymerising to $(NiS)_x$, which is less soluble. The brown liquid is a colloidal solution. By precipitating a nickel solution with an excess of colourless ammonium sulphide and rapidly filtering, a clear solution may be obtained, which gradually becomes brown, confirming the above explanation.

The precipitation of nickel by dimethylglyoxime or potassium thiocarbonate is instantaneous. C. H. D.

Nature of the Metatungstates and the Existence of Rotatory Power in Crystals of Potassium Metatungstate. H. Copaux (*Compt. rend.*, 1909, **148**, 633—636).—A new formula is suggested for the metatungstates in order to express the isomorphous relationships which are exhibited by corresponding borotungstates and metatungstates. The barium salts are formulated as

$$5BaO(B_2O_3,24WO_3),54H_2O \text{ and } 6BaO(3H_2O,24WO_3),54H_2O$$

respectively. According to these formulæ the molecular proportion of barium oxide is different in the two isomorphous salts. A similar difference is found when the potassium salts are compared. A new hydrated potassium metatungstate of the composition

$$K_2O,4WO_3,6{\cdot}5H_2O$$

has been isolated, which is not only isomorphous with the corresponding borotungstate and silicotungstate, but, as in those cases, the crystals exhibit dextrorotatory power. To bring out this above relationship the metatungstate is formulated as $6K_2O(3H_2O,24WO_3),36H_2O$, corresponding with the borotungstate, $5K_2O(B_2O_3,24WO_3),36H_2O$, and the silicotungstate, $4K_2O(2SiO_2,24WO_3),36H_2O$. The continuous series of compounds thus formulated is completed by the phosphotungstate, $3K_2O(P_2O_5,24WO_3),36H_2O$. H. M. D.

Analogies of Uranium with Other Elements. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 175—176).—The parallelism existing between the uranates, R'_2UO_4, diuranates, $R'_2U_2O_7$, peruranates, R'_2UO_5, and the chromates, R'_2CrO_4, dichromates, R'_2CrO_7, and perchromates, R'_2CrO_5, is pointed out, and suggested as a confirmation of the formulæ of the peruranates. It also supports Moissan's view that perchromic acid is to be regarded as a true combination of chromic anhydride and hydrogen peroxide: $CrO_3 + H_2O_2 = H_2CrO_5$. Moreover, diuranic acid, $H_2U_2O_7$, is analogous to dichromic and disulphuric ($H_2S_2O_7$) acids, and to a certain extent to pyrophosphoric, $H_4P_2O_7$, pyroantimonic, $H_4As_2O_7$, and pyrobismuthic, $H_4Bi_2O_7$, acids. E. H.

Uranates. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 173—175. Compare Abstr., 1905, ii, 38).—Since the publication of previous work, the author has come to the conclusion that the formation of uranates by the action of alkalis on uranyl chloride is to be represented generally by the equation: $UO_2Cl_2 + 2M_2O = 2MCl + M_2UO_4$, M representing an atom of a univalent metal. If the reaction takes place in the presence of air, however, peruranates ($UO_5M'_2$ and UO_5M'') are formed, thus: $2UO_2Cl_2 + 4K_2O + O_2 = 4KCl + 2K_2UO_5$. The latter are various shades of red in colour, being thus distinguished from the uranates and diuranates, which are yellow or orange; they agree in properties and reactions with the salts described by Pissarjewsky and Melikoff (Abstr., 1898, ii, 165), and when heated for some time at the temperature of fused potassium hydroxide, lose oxygen, and are transformed into uranates. The peruranates of potassium, sodium, and barium have been obtained; that of calcium could not be obtained free from the uranate. E. H.

Explanation of a Contradiction connected with the Constitution of Alloys of Tin and Lead. W. Guertler (*Zeitsch. Elektrochem*, 1909, 15, 125—129).—The electrical conductivity of alloys of tin and lead is a linear function of the composition, which is interpreted to mean that the metals form neither compounds nor mixed crystals. On the other hand, the study of the heat evolved on solidification (Stoffel, Abstr., 1907, ii, 357; Kurnakoff and Schemtschuschny, Abstr., 1908, ii, 932) indicates that mixed crystals are formed from 0 to about 10% of tin and from about 99·5 to 100%. The thermal data refer to the eutectic temperature (183°), whilst the conductivity data refer to temperatures below 150°. The author thinks it probable that the mixed crystals which exist at 180° decompose at lower temperatures into tin and lead; that some change occurs is proved by a small, but distinct, development of heat, which occurs about 150°. T. E.

Tin Phosphides. Pierre Jolibois (*Compt. rend.*, 1909, 148, 636—638).—The compounds formed by tin and phosphorus have been investigated by metallographic examination of the solid products obtained on cooling various fused mixtures of the two elements. Alloys, in which the percentage of phosphorus varies from one to thirteen, contain the phosphide Sn_4P_3; this was isolated by making the alloy the positive pole in a solution of sodium polysulphide. In these circumstances the uncombined tin dissolves in the solution, whereas the crystals of the phosphide are not acted on. The phosphide has a silver-white colour, and crystallises in small spangles; D^0 5·18, and it begins to dissociate at 480°. It is oxidised by warm nitric acid; hydrochloric acid decomposes it with the evolution of hydrogen and a mixture of the hydrides of phosphorus; it is also acted on by a warm solution of potassium hydroxide with the formation of hydrogen phosphide.

Fused mixtures containing more than 13% of phosphorus can be obtained by heating under pressure. By acting on the products obtained from such mixtures with hydrochloric acid, warm sodium hydroxide solution, and finally with dilute nitric acid at 50°, the phosphide SnP was isolated. This is crystalline, has a metallic appearance, D^0 4·10, and it begins to dissociate into phosphorus and the phosphide Sn_4P_3 at 415°. It is acted on violently by fuming nitric acid. H. M. D.

Thorium. Richard J. Meyer (*Zeitsch. Elektrochem.*, 1909, **15**, 105—106. Compare this vol., ii, 53).—Replying to Karstens (this vol., ii, 243), the author still believes that von Bolton's thorium contained oxide. T. E.

Electrolytic Production of Tin. A. J. M. Thirot (D.R.-P. 203519).—Tin is deposited electrolytically in a coherent deposit from a moderately concentrated solution of sodium stannate, providing that just sufficient sodium sulphide is added to precipitate other metals, such as lead and copper, and that the bath is maintained at 80° and the current density at 300 to 400 amperes per square metre.

G. T. M.

Hydrolysis of Bismuth Halides. Walter Herz and Alfred Bulla (*Zeitsch. anorg. Chem.*, 1909, **61**, 387—395).—Bismuth chloride was shaken with varying quantities of water for twenty-four hours at 25°, the bismuth and hydrogen chloride in the solution being then estimated. The relation $[BiCl_3]/[HCl]^2 = \text{const.}$ holds good over a considerable range of dilution. Alkali chlorides increase the solubility of bismuth chloride. Bromides have a greater influence than chlorides, and nitrates less, in reducing the hydrolysis; sodium sulphate is practically without influence.

Bismuth bromide behaves in the same manner as the chloride. The only basic compounds resulting from the hydrolysis are BiOCl and BiOBr.

Bismuth iodide reacts so slowly with water that equilibrium is hardly to be reached at 25°; experiments are therefore to be made at higher temperatures. Bismuth fluoride is not hydrolysed either by cold or by boiling water. C. H. D.

Bismuth Hydroxide and Its Behaviour towards Alkalis. L. Moser (*Zeitsch. anorg. Chem.*, 1909, **61**, 379—386).—Bismuth hydroxide, free from basic salts, is best prepared by running a solution of a bismuth salt mixed with glycerol into sodium hydroxide and immediately neutralising almost the whole excess of alkali with dilute nitric or acetic acid. If sulphuric acid is used, as recommended by Thibault (Abstr., 1901, ii, 106), the product contains some basic sulphate. The precipitate, after washing with a little alcohol and drying in air, has the composition $Bi(OH)_3$, but readily absorbs carbon dioxide. Over sulphuric acid, water is given off continuously, an arrest at the composition BiO·OH not being observed.

In contact with alkaline solutions, the orthohydrate passes over into the more stable, yellowish-white metahydrate, BiO·OH. On exposure to light the metahydrate obtained in the wet way, but not that prepared by heating the orthohydrate, is converted into a grey modification having the same composition. This grey substance is obtained as an intermediate stage in the conversion to oxide by gentle heat. Bismuth oxide also exists in several modifications (Guertler, Abstr., 1904, ii, 130).

The solubility of bismuth hydroxide in alkalis has also been estimated, the bismuth content of the solutions being determined by Planes' colorimetric method (Abstr., 1904, ii, 93). At 20°, freshly precipitated bismuth hydroxide is practically insoluble in sodium hydroxide up to $N/1$, slightly soluble in solutions up to $4N/1$, and markedly so in more concentrated solutions. At 100° the solubility is greater, although still small in dilute solutions.

C. H. D.

Compounds of Gold with Bromine. FERNAND MEYER (*Compt. rend.*, 1909, **148**, 346—348. Compare Lengfeld, Abstr., 1902, ii, 27).—The direct action of excess of bromine on precipitated gold gives rise to a film of auric bromide, $AuBr_3$, which prevents further action of the bromine. If, however, precipitated gold is continuously shaken with bromine for twelve hours, or alternately heated with it to 100° and cooled, it is entirely converted into auric bromide, which is soluble in excess of bromine and can be obtained pure in black crystals attaining to 6 mm. in length.

The product obtained by subjecting gold to the prolonged action of bromine dissolved in carbon tetrachloride in such proportion as to give $AuBr_2$ is a black powder without definite properties, and is doubtless a mixture of gold with aurous and auric bromides. When auric bromide is heated to its dissociation temperature, bromine distils off and aurous bromide, AuBr, a green substance, remains. At a higher temperature this dissociates into its elements.

The dissociation curves of aurous bromide and auric bromide have been studied, but no evidence of the existence of the compound $AuBr_2$ could be obtained. Auric bromide is volatile in an atmosphere of bromine at 300°.

R. J. C.

Melting Point of Platinum. C. FÉRY and C. CHÉNEVEAU (*Compt. rend.*, 1909, **148**, 401—404).—The melting point of platinum has been variously stated at temperatures varying from 1706° to 1855°, a recent research (Waidner and Burgess, Abstr., 1907, ii, 882) indicating the value 1753°.

The authors have determined the melting point of platinum heated in a variety of ways. The optical pyrometer was employed, and as Wien's law only holds for radiation from black surfaces, it was necessary to determine the emissive power of platinum, which is a function of the temperature. A horizontal platinum wire, heated electrically, broke at 1690°, somewhat below its true melting point. A vertical wire fused into a drop at 1710°. A platinum wire held vertically in the flame of a Meker burner fused into a bead at 1740°. In the coal-gas oxygen flame the temperature of fusion lay between 1700° and 1750°, according as an oxidising or reducing flame was employed.

The conclusion is drawn that the melting point of platinum, like that of silver, depends on the nature of the atmosphere in which fusion takes place. R. J. C.

Nature of the Platinum-Lead Alloys. Nicolai A. Pushin and P. N. Laschtschenko (*Zeitsch. anorg. Chem.*, 1909, **62**, 34—39; *J. Russ. Phys. Chem. Soc.*, 1909, **41**, 23—28).—The electric potential of platinum-lead alloys was measured against lead in a $N/1$ lead nitrate solution. Up to 33 atomic % Pt, the alloys have the same potential as pure lead. At that point a sudden fall occurs, indicating the existence of a compound Pb_2Pt. A second fall occurs at 50 atomic % Pt, corresponding with the compound PbPt. Both these compounds have been recognised by the freezing-point and microscopic methods (Doerinckel, Abstr., 1907, ii, 785), although the composition of the former compound could not be determined with certainty. The third compound found by Doerinckel, richer in platinum than PbPt, is not recognisable by the electrolytic method, as the potential of PbPt is already near that of pure platinum. C. H. D.

Solid Solutions in the Dissociation of the Oxides of Platinum. Lothar Wöhler and W. Frey (*Zeitsch. Elektrochem.*, 1909, **15**, 129—142).—When platinous hydroxide was heated in a vacuous tube (containing phosphoric oxide) at 400°, oxygen was not evolved. After twelve hours the product contained metallic platinum, which was removed by means of *aqua regia*, leaving an oxide with 9·02% of oxygen; two and a-half days' heating gave a similar residue with 9·47% of oxygen. Platinous oxide contains 7·6% of oxygen.

In other experiments at 450° to 470°, oxygen was evolved, and the residue, after extraction of platinum, contained from 9·5 to 10·3% of oxygen. It appears, therefore, that platinous oxide decomposes into platinum and platinum dioxide, which dissolves in the monoxide, lowering its dissociation tension.

For example, a sample of the monoxide heated at 510° gave a pressure of 752 mm., which diminished in forty hours to 203 mm.

When platinum dioxide was heated at 510—515° in a vacuum until its oxygen content (14·1%) was diminished below that of the monoxide (7·6%), the residue contained much metallic platinum; after removing this with *aqua regia*, the residual oxide contained 13·0 to 13·2% of oxygen. When the quantity of oxygen removed was less, so as to leave a substance with approximately the composition of platinum sesquioxide, the result was the same; the oxide remaining after extraction of metallic platinum contained 13·33% of oxygen. It is shown that platinous oxide (dried at 120—150°) is not oxidised by *aqua regia*. It appears, therefore, that platinum dioxide dissociates into the metal and a solid solution of either the monoxide or sesquioxide in the dioxide.

The equilibrium pressures could not be measured, owing to the extraordinary slowness of the reactions. The oxides may be heated for days at temperatures 150° to 200° above the temperature corresponding with equilibrium without losing oxygen. The metal takes up oxygen equally slowly. The dissociation pressures of the monoxide and sesquioxide are, however, higher than that of the dioxide.

The rate of evolution of oxygen from the dioxide at constant temperature exhibits remarkable features. The evolution begins slowly, then becomes very rapid, and finally diminishes gradually. The rapid evolution begins (at 514—520°) when the oxygen content of the oxide has fallen to 11·6 to 12%. It is thought that a supersaturated solution of monoxide or sesquioxide in the dioxide is first formed, and when this has reached a certain concentration it decomposes suddenly. T. E.

Ruthenium and its Compounds. Alexander Gutbier (*Zeit. angew. Chem.*, 1909, **22**, 487—493. Compare Abstr., 1905, ii, 463).—Previous to undertaking a determination of the atomic weight of ruthenium, a study has been made of the behaviour of some of its compounds, more especially the tetroxide and the chloride.

The tetroxide was first prepared by Claus (*Bull. Acad. Sci. St. Petersburg*, 1859, [ii], **1**, 97), who fused the element with potassium nitrate and potassium hydroxide in a silver dish and treated the salt thus obtained with water and passed chlorine through the warmed solution, obtaining the volatile tetroxide in the distillate. This method of preparation, and, indeed, the apparatus described by Claus, has been found to be the best at present known. The quantities used and details of the operation are given in the present paper. Howe (Abstr., 1902, ii, 86) has described a method of preparation, making use of a nickel crucible and sodium peroxide, but it is found that an appreciable quantity of nickel becomes dissolved and is difficult to separate. The tetroxide was obtained by Claus' method as a yellow oil which solidified to a crystalline mass when cooled; the vapour vigorously attacks cork and rubber, and is very poisonous.

Ruthenium tetroxide was purified by repeatedly shaking with warm water to remove all traces of chlorine, separating as completely as possible from water, and finally subliming several times in a vacuum, when it was obtained in beautiful crystals.

Ruthenium chloride, $RuCl_3$, has been prepared by treating the tetroxide with 20% hydrogen chloride solution, and placing it in a cooling mixture, under reduced pressure, for two hours. The solution thus obtained was freed from chlorine and unaltered oxide, and concentrated to a syrup by drawing a current of dry air over the warmed liquid. It was then left over concentrated sulphuric acid in an evacuated desiccator until it solidified to an almost black, crystalline mass.

This solid substance becomes liquid when in contact with the atmosphere, and dissolves in dilute aqueous or alcoholic hydrogen chloride, developing an intense purple-red colour. J. V. E.

Mineralogical Chemistry.

Iodyrite from Tonopah, Nevada. EDWARD H. KRAUS and C. W. COOK (*Amer. J. Sci.*, 1909, [iv], 27, 210—222).—A crystallographic description is given of material from this new locality for the mineral. The crystals occur on quartz and measure 1—5 mm. in length; they are pronouncedly hemimorphic in development, and show combinations of the basal plane, hexagonal prism, and several new hexagonal pyramids: $a : c = 1 : 0{\cdot}8204$. Etching figures, produced by a strong solution of sodium chloride, indicate that the symmetry is that of the dihexagonal-pyramidal class. Analysis gave: Ag, 45·95%; I, 54·01%; D 5·51. Crystals from Broken Hill, New South Wales, are also described. L. J. S.

Talc from Kossoi-Brod, Urals. L. L. IVANOFF (*Zeitsch. Kryst. Min.*, 1909, 46, 221; from *Bull. Soc. Nat. Moscou*, 1906, Nos. 1 and 2, 156—160).—Analysis gave:

SiO_2.	Al_2O_3.	Fe_2O_3, FeO.	MgO.	H_2O.	Total.	Sp. gr.
60·37	1·79	3·13	28·71	5·18	99·18	2·805

Hydrochloric acid extracted SiO_2, 0·58; Fe_2O_3 + FeO, 0·88; MgO, 2·86%. L. J. S.

Physiological Chemistry.

Catalase of the Blood. GEORG LOCKEMANN, J. THIES, and HEINRICH WICHERN (*Zeitsch. physiol. Chem.*, 1909, 58, 390—431).—Sodium chloride inhibits the decomposition of hydrogen peroxide by light, especially by feeble light. The estimation of catalase in the blood by Jolles' method gives the same results if blood is diluted with physiological salt solution or laked with water. Sodium chloride inhibits the catalase action, especially if water has been added; sodium sulphate has scarcely any action. Ferrous ammonium sulphate, ferric ammonium sulphate, and ferric chloride inhibit the decomposition of hydrogen peroxide and the catalase action on blood in the order named, the least active being placed first. Many experiments on the influence of temperature on the reaction-velocity of catalase action are given. White light inhibits the action, then blue and red, red being the least active. Röntgen rays do not affect it. W. D. H.

Part played by the Dissociation of Carbophosphates in Nature. A. BARILLÉ (*Compt. rend.*, 1909, 148, 344—346. Compare Abstr., 1902, ii, 258; 1904, ii, 27).—Soluble carbophosphates, which are formed by the action of carbon dioxide under pressure on normal phosphates, dissociate into hydrogen carbonates and monohydrogen phosphates (M_2HPO_4) in the air.

The production and decomposition of carbophosphates in the blood can give rise to phosphatic calculi, which always contain calcium carbonate as well as calcium phosphate. The carbon dioxide in venous blood is possibly held as sodium carbophosphate, which dissociates in the lungs. Acidic urine contains the carbophosphates of calcium and magnesium, which dissociate on heating, giving a turbidity. Thus the utility of carbonated mineral waters in phosphaturia depends on the formation of soluble carbophosphates. The occurrence of crystalline dimetallic phosphates in fossil bones and in a human skull which was found in a sealed lead coffin, as well as the formation of such natural phosphates as coprolite, are explained on a similar basis. It is supposed that soluble carbophosphates from atmospheric carbon dioxide and the insoluble phosphates of soil play an important part in plant nutrition. R. J. C.

Parthenogenesis. Isidor Traube (*Biochem. Zeitsch.*, 1909, 16, 182—186).—The theory of osmotic pressure described previously (Abstr., 1908, ii, 565) is applied more fully to the case of parthenogenesis. The relationship between the surface-tension of various acids and their parthenogenetic activity is clearly brought out, the values for the capillarity constants previously obtained (Abstr., 1891, 1408) being used for this purpose.

It is also pointed out that substances like chloroform, benzene, toluene, benzoic acid, saponine, solanine, and salts of gallic acid, which, according to Loeb, produce a membrane when added to sea-water, also lower the surface-tension of water. The salts of fatty acids are less active than the fatty acids themselves, and it is shown that they produce a smaller lowering of surface-tension than the acids.

Loeb's views that the partition-coefficient, according to Overton, and the velocity of osmosis are primary factors, are not accepted. Neither is the view that the activity of strong mineral acids which are insoluble in lipoids is due to the liberation by these of free fatty acids from salts of these acids contained in the envelope of the egg.

According to the author, it is necessary that the acids in question diffuse or are adsorbed into the surface of the egg, but it is immaterial whether they are dissolved by the lipoids, as in the case of the higher fatty acids, or whether they are dissolved by the aqueous colloidal phase, as in the case of dibasic acids. A secondary factor is the rate of diffusion or adsorption.

The fundamental factor is the difference in capillary pressure between the surface of the egg and the surrounding aqueous medium produced by the diffusion or adsorption. J. J. S.

Digestion of Mannans and Galactans. H. Bierry and J. Giaja (*Compt. rend.*, 1909, 148, 507—510).—The mannans and galactans of various seeds (*Medicago*, *Trigonella*, *Phytelephas*, *Phœnix*) are not digested by the higher animals, but are converted into mannose and galactose by the digestive juice of species of snails (*Helix*) and of certain *Crustacea*. G. B.

Gastric Digestion of Human and Asses' Milk. LOUIS GAUCHER (*Compt. rend.*, 1909, 148, 361—363).—By working with dogs provided with a duodenal fistula, it is found that both these kinds of milk pass through the stomach twice as fast as cow's milk. In the stomach the casein is not peptonised in any of the three cases. The greater digestibility of human milk is due to its clotting in small flakes; the milk of the ass forms a clot of slight consistency; in either case the evacuation of the stomach takes place with the minimum of mechanical work. G. B.

Comparative Digestibility of Proteins in Gastric Juice. WILLIAM N. BERG (*Amer. J. Physiol.*, 1909, 23, 420—459).—Under uniform conditions, proteins are digested with unequal speed. The order of digestibility in gastric juice is as follows, the most easily digestible being placed first: edestin, myosin, alkali-albumin, acid albumin, fibrin, coagulated egg-white, ossein, nucleo-protein, tendo-collagen, elastin, tendo-mucoid. W. D. H.

Normal Digestion of Proteins in the Dog's Alimentary Canal. V. EMIL ABDERHALDEN, E. S. LONDON, and E. B. REEMLIN. **VI.** EMIL ABDERHALDEN, FLORENTIN MEDIGRECEANU, and E. S. LONDON (*Zeitsch. physiol. Chem.*, 1909, 58, 432—434, 435—437. Compare Abstr., 1908, ii, 514).—Experiments *in vitro* have shown that certain amino-acids are more readily split off than others from the protein molecule by ferment action. The same occurs in the alimentary canal, and can be tested in dogs with fistulæ in appropriate positions; thus from gliadin, tyrosine cannot be detected in the ileum, whereas glutamic acid is still present. The early splitting off of tyrosine, and the later of glutamic acid, is also true for edestin.

The second paper deals with confirmatory results obtained by feeding on casein and egg-albumin. W. D. H.

Absorption Experiments on Dogs with Intestinal Fistulæ. KAORU OMI (*Pflüger's Archiv*, 1909, 126, 428—452).—The dogs employed had various forms of intestinal fistulæ, as in Pawloff's experiments. The quantity of sodium chloride, dextrose, sucrose, and peptone absorbed in the small intestine varies with the concentration of the solutions, whilst that of water varies inversely with the concentration. The secretion of alkali by the intestinal wall bears no relationship to absorption. The absorption of sodium chloride and peptone is less in the jejunum than in the ileum, whilst that of the sugars is better in the ileum than in the jejunum. The secretion of alkali is always smaller in the jejunum than in the ileum. Some preliminary experiments on the absorption of serum from the intestine are also described; a foreign serum (of ox or horse) is worse absorbed by the dog than is dog's serum. The foreign serum acts as a stimulus to intestinal secretion. This property disappears under the influence of the action of pancreatic extracts. W. D. H.

Action of Intestinal Lipase. ANT. HAMSIK (*Zeitsch. physiol Chem.*, 1909, 59, 1—13).—The powdered intestinal mucous membrane of the pig, sheep, and horse possesses the property of synthesising triolein from oleic acid and glycerol, whilst that of the dog and ox does not. W. D. H.

Metabolism in Man with Greatly Diminished Lung Area. THORNE M. CARPENTER and FRANCIS G. BENEDICT (*Amer. J. Physiol.*, 1909, **23**, 412—419).—A full account is given of an experiment on a man in the respiration calorimeter. The man had completely lost one lung, and yet his absorption of oxygen and elimination of carbon dioxide had not materially altered. Previous experiments on animals by Hedin have shown that a corresponding reduction of the lung area has no appreciable effect on gaseous exchanges. This is another instance of the liberal scale on which the animal body is constructed.

W. D. H.

Metabolism in Various Classes of Animals. I. EMIL ABDERHALDEN, CARL BRAHM, and ALFRED SCHITTENHELM (*Zeitsch physiol. Chem.*, 1909, **59**, 32—34).—A striking distinction of metabolic difference is seen in animals so closely related as the cat and dog; the latter animal secretes kynurenic acid, whereas the cat does not, tryptophan being differently catabolised in that animal.

It is found that after feeding a dog on pyridine, the urine contains methylpyridonium hydroxide. The present research confirms this statement, but in the rabbit the same change does not take place; pyridine passes unchanged into the urine. W. D. H.

The Value of Protein Cleavage Products in Metabolism. IX. EMIL ABDERHALDEN, EMIL MESSNER, and HEINRICH WINDRATH (*Zeitsch. physiol. Chem.*, 1909, **59**, 35—42. Compare Abstr., 1908, ii, 1051).—Details are given of metabolism experiments on dogs fed on the cleavage products of casein obtained by the successive action of gastric, pancreatic, and intestinal juices. Although vomiting, as in former cases, was produced after about a week's feeding in some dogs, they remained in equilibrium or even put on nitrogen. No carbohydrate, but only fat, was given in addition to the protein cleavage products. W. D. H.

The Effect of Subcutaneously-administered Urea on Metabolism. ERNST HEILNER (*Zeitsch. Biol.*, 1909, **52**, 216—235).—The administration of urea subcutaneously in rabbits increases nitrogenous metabolism, so that more nitrogen is discharged than can be accounted for in the urea given. This, however, only occurs if the urea is dissolved in physiological saline solution. Hypodermic injection of an aqueous solution of urea produces no effect. Injection of distilled water alone lessens nitrogenous metabolism considerably.

W. D. H.

Fat Synthesis in the Epithelium of the Frog's Intestine during Fat Resorption. ALFRED NOLL (*Arch. Anat. Physiol.*, *Physiol. Abth.*, 1908, Suppl., 145—160, Reprint).—Various fats, fatty acids, and soaps were introduced into the intestines of frogs, and after forty-eight hours the tissues were examined histologically; the solubility in various organic solvents of the fat drops found therein was determined, sometimes directly and sometimes after treatment of the tissues with 5% potassium hydroxide solution; the solubility of the drops after treatment with osmic acid was also investigated. From the differences of the behaviour of fatty acids and fats under these conditions, the conclusion was drawn that fatty acids do not exist in the free form in the cells, but that synthesis of fats takes place in the epithelium. The product obtained when olein is introduced is different from that obtained after introduction of oleic acid. In the former case the drops appeared to consist of pure olein, the cells using the glycerol of the olein for synthesis; in the latter case the oleic acid was in combination with some other component produced by the cells themselves. S. B. S.

Carbohydrate Ferments in Lepidoptera and Diptera in Different Stages of Development. J. Straus (*Zeitsch. Biol.*, 1908, 52, 95—106).—A number of flies and butterflies were investigated; it will be sufficient to give the results in *Bombyx mori* as a sample of the sort of results obtained; this was worked out more thoroughly than the others. In the feeding larva, diastase, invertase, lactase, raffinase, and inulinase were present; in the non-feeding stage inulinase was present; diastase and invertase were present in small amount, and the remainder were absent; in the pupa ten days old there was no inulinase; otherwise the enzymes were the same as in the non-feeding larva; when fourteen days old they were the same, except that a little maltase was present; when eighteen days old there was no diastase and no maltase; otherwise they were the same as when ten days old. In the imago there was glycogen diastase, and a questionable amount of starch diastase; invertase was present, but no lactase or inulinase. W. D. H.

The Rôle of the Small Intestine in Glycogen Formation. Alfred C. Croftan (*Pflüger's Archiv*, 1909, 126, 407—415); Eduard Pflüger (*ibid.*, 416—427).—Croftan states that if dextrose is given by the alimentary canal, glycogen is increased in the liver. If administered by way of a mesenteric vein, there is no such increase. The view is advanced that during absorption dextrose undergoes polymerisation, and this renders it possible for the liver to form glycogen.

Pflüger denies the necessity of this preliminary action of the intestinal wall, and criticises Croftan's methods and conclusions. W. D. H.

Mohr's Work on the Origin of Glycogen from Protein. Eduard Pflüger (*Pflüger's Archiv*, 1909, 126, 511—518).—A criticism of Mohr's work. His conclusions are considered to prove nothing. W. D. H.

Formation of Glycogen from Formaldehyde in the Liver. Karl Grube (*Pflüger's Archiv*, 1909, 126, 585—589).—Previous work has shown that the tortoise's liver is able to form glycogen when perfused by a dilute solution of formaldehyde. H. and A. Euler (Abstr., 1905, i, 633; 1906, i, 140) have shown that in feebly alkaline solutions condensation of formaldehyde to sugar easily occurs, glycollaldehyde being an intermediate product. It has been suggested that the formaldehyde acts merely as a stimulus to the liver to form glycogen from other substances; this, however, cannot be the explanation (or the whole explanation), for other hepatic stimuli (phenol, mercuric chloride, acetic acid, etc.) do not act in the same way. W. D. H.

The Diastatic Ferment of the Liver. Paul Zegla (*Biochem. Zeitsch.*, 1909, 16, 111—145).—The splitting of glycogen in the liver is due to an intracellular enzyme, and not to one derived from blood or lymph. A study of its quantitative action is possible by several methods, for instance, estimation of the glycogen or of the sugar formed from it. The amount of the ferment decreases after death if the liver is kept in toluene; the loss in the human corpse may reach 60%. Phloridzin- and phloretin-diabetes lead to its increase; the same is true for adrenaline-glycosuria in rabbits, to puncture-diabetes, and after section of the vagi. In pancreatic-diabetes in dogs its amount lessens; with regard to human diabetes, further observations are considered necessary. W. D. H.

Influence of Lead Salt on Autolysis. Luigi Preti (*Zeitsch. physiol. Chem.*, 1909, 58, 539—543).—Small quantities of normal lead acetate or nitrate favour, large quantities hinder, autolysis of the liver. The favouring action referred to increases the yield of monoamino-acids, but retards the formation of proteoses. W. D. H.

Liver Extracts and Uric Acid. M. Ascoli and G. Izar (*Zeitsch. physiol. Chem.*, 1909, 58, 529—538).—If a known amount of uric acid is added to liver extract it disappears, but on passing oxygen through the mixture, it reappears again almost quantitatively. The absence of oxygen favours uric acid destruction. W. D. H.

The Decomposition of Uric Acid in the Human Body. Wilhelm Wiechowski (*Arch. exp. Path. Pharm.*, 1909, 60, 185—207).—Allantoin is not present in the amniotic fluid or in infants' urine. The urine of adults contains mere traces; but if allantoin is given subcutaneously it is mainly excreted unchanged. It is therefore probable that in whatever way uric acid is decomposed in the body, allantoin is not an important intermediate product of catabolism. Experiments with surviving organs show that dog's liver and ox kidney decompose uric acid entirely, but that the human liver and kidney have practically no such power. If uric acid is given subcutaneously, it also appears to undergo no appreciable amount of destruction in the body. W. D. H.

The Roe of the Perch. Percaglobulin. Carl Th. Mörner (*Zeitsch. physiol. Chem.*, 1909, 58, 452—453).—Percaglobulin is a name given to a characteristic protein obtainable from the roe of the *Perca fluviatilis*. So far, search for this protein in other fishes, even those closely related to the one named, has led to negative results.

W. D. H.

The Sodium of Frog's Skeletal Muscle. George Fahr (*Zeitsch. Biol.*, 1908, 52, 72—82).—The sartorius of the frog placed in sugar solution gains in weight, as it also does in Ringer's solution, whereas Urano (Abstr., 1907, ii, 978) states it loses weight in sugar solution. After a few hours in the latter, it is almost free from sodium, whilst the loss of potassium is trifling. W. D. H.

The Influence of Chemical Agents on the Affinity of Nerve for Dyes Alfred Fischel (*Zentr. Physiol.*, 1908, 22, 591—597).—The observations were made on small water-living copepods and cladocera, and the dye employed was alizarin-blue. A number of reagents and drugs were employed, most of which were fatal. Physostigmine produced paralysis, but did not hinder the dyeing of the nerve. On the other hand, coloration of the nerve was seldom seen if magnesium chloride or caffeine hydrochloride was employed. In potassium nitrate, calcium chloride, chloral hydrate, guanidine carbonate, and quinine hydrochloride, the animals lived longer, but the nerves did not take the stain; the muscles, however, were coloured, which shows the dye had got into the circulation. W. D. H.

Composition of the Membrane of the Fat Particles of Milk. Emil Abderhalden and W. Völtz (*Zeitsch. physiol. Chem.*, 1909, 59, 13—18).—This membrane is generally supposed to consist of caseinogen, but an investigation of the cleavage products shows that it is not so. There are quantitative differences in the yield of tyrosine and glutamic acid, and glycine is present, whereas it is absent in caseinogen and lact-albumin. Possibly a mixture of proteins is present in the envelope of the oil globules. W. D. H.

The Reducing Properties of Milk. Schardinger's Reaction. Richard Trommsdorff (*Centr. Bakt. Par.*, 1909, i, 49, 291—301).—It is known that milk which contains bacteria possesses strong reducing powers and also that fresh unheated milk gives a colour with Schardinger's reagent (5 c.c. formalin, 5 c.c. saturated alcoholic solution of methylene-blue, and 90 c.c. of water) under suitable experimental conditions. Many hypotheses have been put forward to account for these phenomena. The difficulty of deciding the the exact part played by bacteria has hitherto been the impossibility of getting milk free from organisms without having recourse to heat or antiseptics. The author has got over the difficulty by drawing milk from the udder by means of a small catheter; in this way quantities of sterile milk can be obtained without having to treat the milk in any way whatsoever. Such milk shows no reducing action, and is therefore free from the so-called "reductase"; on the other hand, it does colour Schardinger's reagent, but the course of reaction could not be determined. E. J. R.

Lævulose in Urine. Hans Malfatti (*Zeitsch. physiol. Chem.*, 1909, 58, 544—546).—A discussion of recent work and methods relating to the presence of lævulose in diabetic urine. With care, weakly positive reactions for lævulose are sometimes obtainable.

W. D. H.

Dicalcium Phosphate as a Urinary Sediment. Carl Th. Mörner (*Zeitsch. physiol. Chem.*, 1909, 58, 440—451).—The occurrence of dicalcium phosphate, $Ca_2H_2(PO_4)_2,4H_2O$, in crystalline form as a urinary sediment is comparatively rare. The present paper relates to the form of the crystals and the circumstances which lead to their deposition. The reaction must be neutral, and the amount of calcium in the urine usually in excess; abundance of sodium chloride is also favourable. The deposit can be obtained from many urines by shaking with aniline or with alcohol, and in a larger number by the addition of both reagents (3 c.c. of aniline, and 20 c.c. of 90% alcohol per 100 c.c. of fresh non-alkaline urine). W. D. H.

Oxygen and Creatinine Excretion. C. J. C. van Hoogenhuyze and H. Verploegh (*Zeitsch. physiol. Chem.*, 1909, 59, 101—111. Compare Abstr., 1908, ii, 971).—Creatine is regarded as a product of protein catabolism, and it is partly destroyed and oxidised and partly converted into creatinine and excreted. Some experiments on dogs are given which show that administration of creatine increases the creatinine output; but the bulk of the paper deals with the influence of oxygen. Inhalation of large quantities of oxygen causes no alteration in the excretion of creatinine. Residence at a great altitude produced very little change; thus in one of the authors (who were on a creatinine-free diet throughout) the daily excretion at Utrecht was 1·839 grams; on Monte Rosa it was 1·903 and 1·965. In the other author the rise was even less. W. D. H.

Proteic Acids in Urine in Health and Disease. Witold Gawiński (*Zeitsch. physiol. Chem.*, 1909, 58, 454—468; *Bull. Acad. Sci. Cracow*, 1908, 851—853).—A method for the estimation of Bondzyński's proteic acids in urine is described in detail; it depends on the complete insolubility of the barium salts in absolute alcohol.

The effect of diet is negligible; in milk, meat, and mixed diet, the amount of proteic acid nitrogen varies from 4·5 to 6·8% of the total nitrogen. In typhoid fever, this figure rises to 9—14, falling off in the second week of the disease and still more so in the third week. It is also increased in cases of jaundice. Estimations are also given of the various forms in which sulphur is excreted under these conditions.

W. D. H.

The Relative Importance of Inorganic Cations, especially those of Sodium and Calcium in the Causation of Gout and the Production of Gouty Deposits. William G. Little (*Bio-Chem. J.*, 1909, 4, 30—37).—It was found that the following is the order of the solubility of the acid urates of various metals: potassium, most soluble, then sodium, magnesium, and calcium urates. One part of acid calcium urate dissolves in 4760 parts of cold water, whereas one part of the corresponding sodium salt dissolves in 1030. In the presence of sodium chloride, however, the conditions are quite different, and 3420 parts of 0·5% sodium chloride solution will dissolve one part of calcium urate, whereas sodium urate requires 44,400 parts of the same solution. The addition of small quantities of calcium salts to pure water also diminished the solvent capacity for sodium urate. The significance of these facts in reference to gouty attacks and the formation of gouty tophi is discussed. S. B. S.

Chloride Metabolism in Typhoid Fever. Schwenkenbecher and Inagaki (*Arch. exp. Path. Pharm.*, 1909, **60**, 166—184).—If 10 to 20 grams of sodium chloride are given to typhoid patients, a large fraction of the chlorine is retained. This is attributed to various circumstances, such as enfeebled circulation and kidney function, and degenerative processes in the tissues.

On the other hand, many healthy people, taking the same sort of diet as typhoid patients take, show also a slow excretion of chlorides, and certain typhoid patients do not exhibit it at all. W. D. H.

Antagonism between Trisodium Citrate and Calcium in their Action on the Heart and its Inhibitor Nerve Supply. H. Busquet and V. Pachon (*Compt. rend.*, 1909, **148**, 575—578).—There is a chemical antagonism between trisodium citrate and calcium chloride in their action on the heart and on the vagus nerve. The beating of the frog's heart is stopped by perfusion *in situ* with 0·6% sodium chloride solution containing 0·12% sodium citrate and 0·005% calcium chloride, but is started again when the heart is supplied with a solution containing three times as much calcium chloride. Similarly, the inhibitor effect of vagus stimulation is abolished by perfusing the heart with saline solution containing 0·05% sodium citrate and 0·005% calcium chloride, but is re-established by a saline solution containing the same amount of citrate, but twice as much calcium. G. B.

The Behaviour of Salol and Distearyl Salicylyl Glyceride in the Organism. Stanislaus Bondzyński and Vincenty Humnicki (*Bull. Acad. Sci. Cracow*, 1908, 841—851).—The rate of elimination of salicylic acid and phenol in the urine was determined after the ingestion of salicylic acid, salol, and distearyl salicylyl glyceride, the last-named substance being prepared by the action of silver stearate on dichlorohydrin salicylate. It is a product of fat-like nature, m. p. 46—49°. Unlike trisalicylyl glyceride, it is completely resorbed after ingestion. It is found that salicylic acid is eliminated somewhat later after the ingestion of salol and the glyceride than it is after salicylic acid. The phenol is, however, eliminated much sooner (after salol ingestion) than the salicylic acid.

Salicylic acid is estimated in the urine by boiling first with hydrochloric acid, evaporating to dryness the solution after making alkaline with sodium hydroxide, and then extracting the residue with alcohol. After evaporation of the alcohol from this extract, the residue is dissolved in water, the solution thus obtained acidified, and the salicylic acid extracted therefrom by ether. This extract is dissolved in alcohol, and barium hydroxide in concentrated aqueous solution added. The salicylic acid is thereby precipitated quantitatively as barium salt, from which it is recovered by dissolving the salt in acid and extracting the solution thus obtained with ether.

Phenol was estimated as the tribromo-compound. The author gives the details of the method for separating it from salicylic acid, which depends chiefly on the greater volatility of the former in steam.

S. B. S.

Physiological Action of the Alkaloids of the Papaveraceæ. Worth Hale (*Amer. J. Physiol.*, 1909, **23**, 389—405, 406—411).—Twelve alkaloids were investigated, and all in various strengths depress the frog's heart after previous stimulation. They are arranged in order of activity, and morphine is the least active in this direction.

The whole series act also as depressants of motor nerve endings; here narceine is the least active, morphine coming next. W. D. H.

Physiological Actions of *l*-, *d*-, and *dl*-Suprarenine (Adrenaline). II. Emil Abderhalden and Friedrich Thies (*Zeitsch. physiol. Chem.*, 1909, **59**, 22—28. Compare this vol., ii, 159).—*d*-Suprarenine causes little or no dilatation of the frog's pupil, or glycosuria, in doses in which *l*-suprarenine produces both these effects; *dl*-suprarenine produces these effects in degree corresponding to the amount of *l*-suprarenine it contains. W. D. H.

Acid Poisoning. III. Hans Eppinger and Fritz Tedesko (*Biochem. Zeitsch.*, 1909, **16**, 207—216. Compare Abstr., 1907, ii, 86).—The experiments recorded confirm previous results; the susceptibility to the toxic action of acids is not a fundamental distinction between carnivorous and herbivorous animals, for if a dog receives no protein food it is easily poisoned by acid, and the sheep becomes resistant to acid when it takes protein freely. W. D. H.

The Injury to Health Caused by Long-continued Ingestion of Sodium Sulphite in Small Doses. Karl B. Lehmann and Adolf Treutlein (*Arch. Hygiene*, 1909, **68**, 303—318).—The authors failed to corroborate Kionka's statement that long-continued ingestion of sulphite of animals causes small hæmorrhages throughout the body, although in some cases the feeding with food containing the sulphite was continued for two hundred days. The doses chosen were of such magnitude as to be comparable with the quantity that could be ingested by the human subject living on foods preserved with the maximum quantity of sulphite. S. B. S.

Hygienic Studies on Nickel. Karl B. Lehmann (*Arch. Hygiene*, 1909, **68**, 421—465).—The amounts of nickel which could be dissolved by cooking various classes of food-stuffs in nickel utensils were determined, and it was found that if the whole of the food were cooked in such vessels, the total amount of metal that a man could ingest amounted to 2 mg. per kilo. of body-weight. Cats or dogs which had taken quantities of nickel amounting to from 6 to 10 mg. per kilo. for one hundred to two hundred days remained normal in life, and showed no abnormal post-mortem appearances, although in two cases large amounts of the metal were stored up in the tissues. The conclusion is drawn that there is no danger of toxic effects from the use of nickel utensils. S. B. S.

Chemical and Toxicological Studies on Tobacco, Tobacco-smoke, and Smoking. Karl B. Lehmann [with Joseph Biederbeck, Ludwig Bitter, Alban Heimannsberg, Krepelka, Jakob Kuhles, H. K. Lang, S. Noda, Franz Schmidt, T. Tani, Harry Warburg, and Adolf Weger] (*Arch. Hygiene*, 1909, 68, 319—420).—The investigations were directed towards the quantitative determination of the constituents of smoke, which were collected by means of specially devised apparatus. The smoke was divided into two portions, namely, a by-stream coming from the lighted end of the cigar or object smoked, and the main-stream, corresponding to the mouth end. The principal products quantitatively determined were nicotine, pyridine, and ammonia. Pyridine was separated from the other bases by steam-distilling in the presence of acetic acid, under which conditions it alone is volatile. Nicotine was estimated by the bismuth potassium iodide method of Keller. The amounts of the various products that are obtainable in the smoke from various kinds of tobacco smoked in varying ways were also determined; also the amounts of the bases that are absorbed in the mouth under varying conditions. The latter factors were determined either by estimating the bases obtained in the washings, when the smoker rinses the mouth after each whiff, or by estimating the bases in the smoke, when after each puff he exhales into a gas-holder, and comparing the amounts with the total obtainable from smoke of the same materials when smoked in the apparatus. Investigations were also made of the oily matters, carbon monoxide and hydrogen cyanide. The only product obtained which would account for toxic symptoms was nicotine. The difference between "strong" and "mild" tobacco was found to depend, not on the actual amount of nicotine contained therein, but rather on the quantity that was absorbed in the mouth during the process of smoking, which varies considerably with the different kinds of tobacco. S. B. S.

Chemistry of Vegetable Physiology and Agriculture.

The Part Played by Bacteria in the Formation of Fusel Oil. Hans Pringsheim (*Biochem. Zeitsch.*, 1909, 16, 243—245. Compare Abstr., 1908, ii, 316). Rabuteau (*Compt. rend.*, 1878, 87, 500) has noticed previously the presence of *n*-butyl and *iso*propyl alcohols in a fusel oil obtained from potatoes. The author considers that these are formed from the fermenting material by means of bacteria.

J. J. S.

Sterilisation of Milk by Ultra-violet Rays. Victor Henri and G. Stodel (*Compt. rend.*, 1909, 148, 582—583).—Milk infected with various bacterial cultures and the ordinary milk of commerce can be readily sterilised without appreciable rise of temperature by exposure to the ultra-violet rays of a quartz mercury lamp. G. B.

The Action of Bacteria on Azo-colouring Matters. Karl Frégonneau (*Centr. Bakt. Par.*, 1909, i, 49, 276).—Certain acid-producing organisms, including *Proteus vulgaris*, *P. mirabilis*, *Bacillus subtilis*, *B. coli communis*, etc., were grown in media coloured with methyl-orange, but no pink coloration appeared. It is therefore clear that the methyl-orange has been decomposed, and the author suggests that reduction to sulphanilic acid and *as*-dimethyl-*p*-phenylenediamine may have taken place, without, however adducing any experimental evidence of the reaction. The change is examined to a certain extent from the purely bacteriological side. E. J. R.

Azotobacter Chroococcum Beij. Severin Krzemieniewski (*Bull. Acad. Sci. Cracow*, 1908, 929—1051).—Pure cultures of *Azotobacter chroococcum* fix only very small amounts of nitrogen in ordinary non-nitrogenous nutritive media. A marked increase in nitrogen fixation is obtained by addition of free humic acid (from soil) or potassium, sodium, or calcium humate, the increase varying according to the soil from which the humus is obtained. Artificial non-nitrogenous humus from sugar and soil humus which has been boiled with hydrochloric acid have very little effect on nitrogen fixation by *Azotobacter*.

In presence of dextrose, *Azotobacter* can fix as much as 17 mg. of nitrogen per gram. The utilisation of carbonaceous nutrients varies with the amount present, and both an excess and a deficiency below the optimum amount result in a diminished fixation of nitrogen in relation to the amount of carbon consumed.

No acids, alcohol or hydrogen was found to be produced by *Azotobacter*. The relation of oxygen consumed to carbon dioxide produced is approximately 1, or a little higher when dextrose is employed, and a little lower with mannitol.

The optimum temperature for *Azotobacter* is about 28°. At 33° its development is greatly retarded, whilst at temperatures below 28° the utilisation of dextrose is less economical in relation to the amount of nitrogen fixed. At 9° development is stopped altogether.

Fixation of nitrogen by *Azotobacter* is not influenced by *Radiobacter* and other bacteria. N. H. J. M.

The Production of Indole by Bacillus coli communis. W. C. de Graaff (*Centr. Bakt. Par.*, 1909, i, 49, 175).—Several varieties of *Bacillus coli* organisms were propagated on glycerol-agar and then inoculated into peptone water; they were kept under definite conditions, and the amount of indole they produced was determined by Herter and Foster's method. It was found that one and the same variety always gives rise to the same amount of indole under the same conditions. The formation of indole reaches a maximum in three weeks; in doubtful cases the experiment should therefore be continued for this full period. Different varieties of the coli organism generally produce dissimilar amounts of indole. The quantity produced does not depend on the virulence of the organism; thus, of the organisms investigated, two were very virulent (K and St_1), yet the latter yielded only a small amount of indole. Alkalinity of the medium and absence of air diminish the production of indole, whilst dextrose stops it altogether. Peptone is necessary; from bouillon alone no indole is formed. E. J. R.

The Coli-aerogenes Group of Organisms. Robert Burri and M. Düggeli (*Centr. Bakt. Par.*, 1909, i, 49, 145).—The authors have studied sixty-five organisms of the coli-aerogenes group with particular reference to methods of classification. They devised a simple method of estimating the volume of gas evolved during fermentation which can be applied to a large number of samples, and will, they consider, prove a useful addition to the technique of a bacteriological laboratory. Briefly, the method is to cultivate the organism on an agar medium in a thick-walled, inverted, and graduated test-tube, and arrange the conditions so that the gas evolved shall force the medium down the tube and thus allow a direct reading of its volume. A simple device for estimating the amount of carbon dioxide in the gas is also described.

Applying this method to a number of organisms, they find it enables them to discriminate fairly sharply between different types. The quantity of gas evolved under definite conditions, and the proportion of carbon dioxide present, form characteristic tests for the various organisms. By varying the carbohydrates, it is possible to observe other differences. In this way they succeeded in dividing up their organisms into a number of sub-groups containing similar members, but varying according to their origin. These sub-groups are discussed from the standpoint of mutation. E. J. R.

Influence of Ethyl Alcohol on Yeast Fermentation. Martin Kochmann (*Biochem. Zeitsch.*, 1909, 16, 391—398).—The effect of alcohol on the fermentation of dextrose by brewery yeast has been studied with the help of the Schulz automatic recording apparatus. The addition of large quantities has an adverse effect; smaller quantities have an accelerating influence, the optimum being at concentrations of 1 in 300 to 500. Under these conditions, the initial fermentation is accelerated, and slightly more gas is produced in a given time. The accelerating influence of alcohol is regarded as quickening the production of ferment and not to any influence on the zymase. E. F. A.

Calcium and Magnesium in Plant Seeds. Richard Willstatter (*Zeitsch. physiol. Chem.*, 1909, 58, 438—439).—In the seeds of cereals (wheat, rye, maize, etc.), the amount of magnesium which the plant requires for the formation of chlorophyll is more abundant than that of calcium. The results are stated quantitatively in a table. W. D. H.

Presence of Amylase in Old Seeds. Brocq-Rousseu and Edmond Gain (*Compt. rend.*, 1909, 148, 359—361).—Corn which had been preserved for fifty years in a glass bottle had lost its germinating power, but still contained a ferment capable of hydrolysing starch. G. B.

Plant Ferments. W. W. Bialosuknia (*Zeitsch. physiol. Chem.*, 1909, 58, 487—499).—An investigation of many seeds shows that ferments capable of acting on animal protein are absent, although those acting on vegetable protein are present. The extract in most cases curdles milk. Oxydases are often present, but the results in different seeds present great variations. In relation to diastatic ferments, the rapidity of action and the kind of sugar formed vary. W. D. H.

The Nature of Cyanogen Compounds in Kirschwasser. Xavier Rocques and L. Lévy (*Compt. rend.*, 1909, 148, 494—496 *).—When this spirit is two to three years old, it does not behave on distillation like a freshly-prepared or old solution of hydrogen cyanide in 50% alcohol; the hydrogen cyanide is only partly in the free state, and a portion of it has become combined with fatty substances of high molecular weight. G. B.

The Amount of Chlorine in Leaves. Albert J. J. Vandevelde (*Bull. Soc. chim. Belg.*, 1909, 23, 84—88).—A number of analyses are given, showing the percentage of chlorine in the dry matter of leaves gathered in May, July, and September. The percentage was found to increase regularly in *Tilia*, *Syringa*, *Ligustrum*, *Æsculus*, *Sorbus*, *Vitis*, *Ampelopsis*, from about 0·3 to about 1%. It fell to a minimum in July and rose to a maximum in September in *Sambucus*, *Corylus*, and *Salix* (about 0·3 to 0·6%). There was a minimum in May and maximum in July in *Fagus*, *Prunus*, *Ribes*, and *Rubus*, but irregularities showed themselves in this group. In *Carpinus*, and occasionally in *Ribes*, the chlorine rose to a maximum in July and a minimum in September. The percentage decreased regularly from May to September in *Quercus*, *Pyrus*, *Aucuba*, *Ilex*, *Rhododendron*, and *Hedera* (about 0·3 to 0·1%). It was a maximum in May and minimum in July in *Pavia*, *Castanea*, *Acer*, *Symphoricarpus*, *Betulus*, and *Deutzia*. In certain other cases the fluctuations were irregular, including *Populus*, *Ulmus*, *Fagus*, *Prunus*, *Ribes*, *Rubus*, but the causes of the fluctuations were not determined. E. J. R.

The First Stages in the Development of Perennial Plants Compared with those of Annuals. Gustave André (*Compt. rend.*, 1909, 148, 515—517. Compare this vol., ii, 174).—The cotyledons yield to a perennial seedling about the same proportion of potassium and of nitrogen as is yielded by the cotyledons of an annual plant; in the latter case the transference of saline constituents from the cotyledons is more rapid, but not more complete. G. B.

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* and *Ann. Chim. anal.*, 1909, 14, 138—140.

The Influence of Aluminium Salts on Protoplasm. M. Fluri (*Naturw. Rundsch.*, 1909, 23, 610—612).—*Spirogyra* cells in the light lose their starch under the influence of aluminium salts, very weak solutions of the latter sufficing to bring about this result. This effect may be due to an acceleration of the diastatic action induced by the aluminium salts, but is more probably due to an increase in the permeability of the protoplasmic membranes brought about by these salts. Precipitated albumin had a greater absorptive capacity than dissolved albumin, and as the soluble aluminium salts have a marked tendency to precipitate albumins, these substances are in this way rendered more permeable. G. T. M.

The Presence of Fluorine in Grapes. F. Leperre (*Bull. Soc. chim. Belg.*, 1909, 23, 82—84).—These experiments were undertaken in connexion with the analysis of wines; if fluorine does not occur in grapes, it clearly should not occur in pure wines. Dried grapes from Malaga and from Asia Minor (sultanas) were incinerated, and 5 grams of the ash were tested for fluorine. In most cases the results were wholly negative; in the others there were possible indications of a slight trace of fluorine. When fluorides are found in wine, it is clear that they must have been added. E. J. R.

Occurrence of Stachyose and a Glucoside Hydrolysable by Emulsin in the Subterranean Parts of Lamium album. L. Piault (*J. Pharm. Chim.*, 1909, [vi], 29, 236—241).—An alcoholic extract of the subterranean portions of *Lamium album* can be separated by treatment with a mixture of alcohol and ethyl acetate into two parts. The insoluble portion contains stachyose (manneotetrose) (Tanret, Abstr., 1903, i, 606) and the soluble part a glucoside, which is decomposed by emulsin, yielding a dextrorotatory reducing sugar. T. A. H.

Vegetable Phosphatides. III. Ernst Winterstein. **IV.** Ernst Winterstein, and K. Smolenski. **V.** K. Smolenski. **VI.** Ernst Winterstein and L. Stegman (*Zeitsch. physiol. Chem.*, 1909, 58, 500—505, 506—521, 522—526, 527—528. Compare Abstr., 1908, ii, 218).—This series of papers relates to a number of vegetable phosphatides, but their final identification is not yet possible. The first paper relates to one prepared from the seeds of *Lupinus albus*. It contains phosphorus 3·6%, and nitrogen 0·9%, and yields 16% of sugar on cleavage. The second deals with phosphatides from wheat meal; one of these, soluble in alcohol, yields ammonia, choline, and other nitrogenous substances, some of which are basic; a carbohydrate-phosphatide is also present. The third paper deals with some points of detail in relation to wheat phosphatides, and the fourth with a phosphatide from green *Recinus* plants, which yields 5·3% of phosphorus, 6·7% of calcium oxide, and no sugar. W. D. H.

Maltases of Maize. R. Huerre (*Compt. rend.*, 1909, 148, 505—507. Compare this vol., ii, 258).—Further examples of maltases acting at high and at low temperature are given. These differences are due to differences in the medium; each variety of maize appears to have its own special maltase. G. B.

The Fruit of Medeola Virginica and Ampelopsis Quinquefolia. Lois E. Poyneer and H. Leroy Duffin (*Chem. News*, 1909, 99, 99—100).—The fruit of the Indian cucumber (*Medeola Virginica*) contains lævulose. The hard kernels enclosed in the fruits yield nearly 10% of oil, of which a portion is volatile and the remainder resembles porpoise oil and has a saponification equivalent 254·8.

The fruit of the Virginia creeper (*Ampelopsis quinquefolia*) contains lævulose, tannin, oxalic acid, and 11·27% of oil (D 0·9503), which on standing separates into two portions, of which the lower solidifies on cooling and then has m. p. 0·8°.

A complete analysis of the ash from each kind of fruit is given, showing that both are comparatively rich in potassium. T. A. H.

An Organic Vegetable Compound of Iron. P. Joseph Tarbouriech and P. Saget (*Compt. rend.*, 1909, 148, 517—519).—Of all the plants hitherto analysed, *Rumex obtusifolius* is richest in iron; the dried root contains 0·447% Fe. The iron is in a state of organic combination in a substance containing C, H, N, P, and other inorganic constituents besides iron. This substance is soluble in alcoholic hydrochloric acid; the iron is only partly split off by boiling with 1% hydrochloric acid. With acid of 10%, the substance is decomposed with formation of a reducing sugar. The substance appears to be related to the nucleones of Siegfried. G. B.

The Sugars of the Tobacco Plant. Gaspare Ampola and Francesco Scurti (*Ann. R. Staz. chim. agrar. sper. Roma*, 1907–8, [ii], 2, 312—316).—The suspected presence of sugars in normal tobacco leaves is important in connexion with the question of adulteration. The inflorescence and seeds are found to contain dextrose, identified by its reactions and its conversion into the phenylhydrazone. The sugar present in the leaves is gummy and uncrystallisable (compare Müller, Abstr., 1886, 904). The presence of allantoin in tobacco leaves (Scurti, Abstr., 1907, ii, 124), together with dextrose, makes it probable that the two compounds occur in the form of a readily hydrolysable allantoin glucoside. C. H. D.

Amount of Sugar in Beet Manured with Nitrogen. Hermann Briem (*Zeitsch. Zuckerind. Böhm.*, 1909, 33, 391—394).—Experiments with beet grown in four different kinds of soils, without nitrogen and with 60 kilograms of nitrogen per hectare as sodium nitrate, ammonium salt, calcium cyanamide, and calcium nitrate. The average amounts of sugar for all the soils only varied from 17·1 (without nitrogen) to 17·3% (ammonium salt).

Further experiments with the different soils, in which the effects of sodium nitrate applied all at once or in two portions were compared, showed that a single application before June 20 does not lower the percentage of sugar. N. H. J. M.

Accumulation of Nitrogen in Relation to Soil Conditions. Theodor Remy (*Centr. Bakt. Par.*, 1909, ii, 22, 561—651).—Application of a suitable substance as source of energy is essential in the case of ordinary arable soil to obtain a marked accumulation of nitrogen. Small gains of nitrogen may occur in soils not too deficient in humus and calcium carbonate. The presence of free acids prevents any material fixation of nitrogen. Equivalent amounts of lime and magnesia have almost exactly the same effect on nitrogen fixation, whilst potassium and sodium carbonates are less favourable.

No definite relation between the percentage of nitrogen in soils and fixation of nitrogen could be established. No gain of nitrogen could ever be detected in peaty soils.

An experiment on nitrogen fixation in large quantities of soil is described. Three lots of soil, 300 kilograms, (1) without further treatment, (2) with addition of calcium carbonate, and (3) with calcium carbonate and 2% sucrose, were kept in layers 10 cm. high for a few weeks at a temperature of 22—25°. Addition of calcium carbonate alone had no effect, whilst addition of calcium carbonate and sucrose resulted in a gain of 141 mg. of nitrogen per kilogram. Pot experiments were next made with three similar lots of soil each with four different plants, all followed by mustard. The results showed that the nitrogen fixed under the influence of sucrose (the amount of sucrose was 1% in this experiment) was in a readily available form, and that the yields of mustard and maize grown in the soil were twice as great as in the other soils, whilst the difference in the case of beet was still greater. The average amounts of nitrogen in the first crops from the three soils and the amounts in the second crops (mustard) were:

Soil.	I.	II.	III.
Nitrogen in 1st crop	0·225	0·217	0·463
,, 2nd ,, ...	0·351	0·330	0·118

N. H. J. M.

Assimilation of Potassium from Soils. Gustav Wimmer, Hermann Wilfarth, W. Krüger, Hermann Roemer, Gerhart Geisthoff, O. Ringleben, and J. Storck (*Chem. Zentr.*, 1909, i, 395—396; from *Arb. deut. landw. Ges.*, 1908, No. 143).—Pot experiments with various plants to ascertain the laws by which potassium is taken up from the soil and also whether it is possible to ascertain by pot experiments whether and to what extent soils are deficient in potassium.

The influence of soil moisture and manuring and the return of potassium to the soil are discussed (in the original paper), and also the relation of lower organisms to potassium assimilation and the effect of nematodes. N. H. J. M.

[Composition of Rain water collected at Garforth.] R. S. Seton (*Rep. Univ. Leeds and Yorks. Counc. Agric. Education*, 1908, No. 74, 17).—Analyses of rain-water collected from October, 1906, to

September, 1907, and October, 1907, to September, 1908. The following results were obtained:

(1). In parts per million.

	Rainfall in inches.	Nitrogen As NH_3.	Nitrogen As N_2O_5.	Nitrogen Albuminoid.	Cl.	SO_3.	SO_2.	Acidity as H_2SO_4.
1906—1907...	26·44	1·06	0·236	—	3·66	11·94	—	2·14
1907—1908...	29·16	0·773	0·481	0·163	3·36	10·85	2·71	4·34
Average ...	27·80	0·934	0·377	—	3·60	11·67	—	3·41

(2). In lbs. per acre.

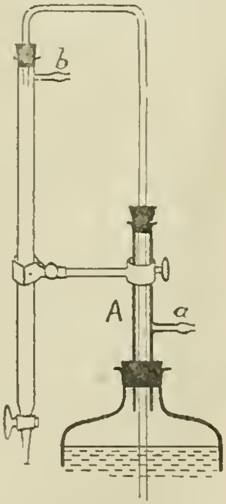
	Rainfall in inches.	Nitrogen As NH_3.	Nitrogen As N_2O_5.	Nitrogen Albuminoid.	Cl.	SO_3.	SO_2.	Acidity as H_2SO_4.
1906—1907...	26·44	6·42	1·424	—	22·12	72·10	—	12·95
1907—1908...	29·16	5·327	3·316	1·128	23·17	74·81	18·65	29·93
Average ...	27·80	5·873	2·370	—	22 64	73·45	—	21·44

The nitrogen as ammonia amounted to 71·2%, and as nitrates, 28·8%, of the total (excluding albuminoid nitrogen). N. H. J. M.

Analytical Chemistry.

New Burette Attachment to Store Bottle. VON HEYGENDORFF (*Pharm. Zeit.*, 1909, **54**, 159).—A description is given of a convenient arrangement for working with standard solutions, whereby the burette may be filled directly from the stock solution with a minimum chance of evaporation; the apparatus is, moreover, not easily broken. *A*, is a stout glass tube carrying the feed tube to the burette; the side tubes, *a* and *b*, may be closed by suitable caps when the apparatus is not in use.

From the accompanying sketch it should be evident that suction at *b* will cause filling of the burette; the air entering at *a* should be dried by attaching a drying tube to this inlet. J. V. E.



Use of Pinchcock Burettes for Titrations with Iodine and Permanganate. LUCIEN L. DE KONINCK and LEJEUNE (*Bull. Soc. chim. Belg.*, 1909, **23**, 79—82).—The authors confirm the experiments of Lunge showing the rapid action of iodine on rubber tubing; pinchcock burettes should, therefore, not be used when titrating with iodine. Stopcock burettes may be safely greased with vaselin.

Lunge's experiments agree with a statement made by de Koninck and Dietz in 1869 that a pinchcock burette may be used for permanganate titrations if the rubber is not kept in contact with the permanganate for any length of time. L. de K.

The Gasparini Electrolytic Process for the Removal of Organic Matter in the Detection of Poisons. Mario Miorandi (*Gazzetta*, 1909, **39**, i, 175—179).—In Gasparini's method for decomposing organic matter (Abstr., 1904, ii, 785), the material is treated with nitric acid and subjected to electrolysis. The destruction is brought about by oxygen and by oxides of nitrogen. The process has some disadvantages, and it is found that by the use of carbon electrodes instead of platinum, and of ammonium persulphate in place of nitric acid, the destruction is made very rapid and complete. Hydrogen peroxide gives less satisfactory results. C. H. D.

Apparatus Used in Rapid Methods of Electroanalysis. Analysis of Brass. T. Slater Price and T. C. Humphreys (*J. Soc. Chem. Ind.*, 1909, **28**, 117—123).—After describing the more important forms of apparatus with rotating anode, cathode, or electrolyte which have been employed in rapid electroanalysis, the authors give an account of experiments on the estimation of copper and zinc in brass by a constant current method. The apparatus and method of working have been described previously (compare Price and Judge, *Trans. Faraday Soc.*, 1906, **2**, 85).

From the results of a series of experiments at 3 volts and 3 amperes with rotating cathode, it is shown that copper is seldom deposited quantitatively when nitric acid is the only acid present, but precipitation is complete when sulphuric acid or zinc sulphate is added.

In estimating the copper and zinc in brass, about 0·7 gram of the latter is dissolved in 4 c.c. of concentrated nitric acid and a little water; the solution is diluted to 75—100 c.c. One c.c. of strong sulphuric acid is added, and the copper deposited at 3 volts and 3 amperes, which takes about twenty to thirty minutes. The solution is evaporated nearly to dryness to drive off the nitric acid, diluted, a concentrated solution of sodium hydroxide added until the zinc begins to precipitate, ammonia is added to redissolve the precipitate, the solution is warmed, any ferric hydroxide is filtered off, glacial acetic acid is added until the solution is just acid, and the latter electrolysed at 4—4·5 volts and 2 amperes. The zinc is completely deposited in about twenty minutes. A modification of this method, which avoids the lengthy evaporation to get rid of the nitric acid, is also described.

In order to obtain satisfactory results, it is necessary to remove the lead, tin, and iron, if they would otherwise be present as precipitates suspended in the electrolyte. G. S.

Preparation of Standard Hydrochloric Acid. George A. Hulett and W. D. Bonner (*J. Amer. Chem. Soc.*, 1909, **31**, 390—393).—Hydrochloric acid, D 1·10, is distilled until three-quarters has passed over. The residue then shows a constant boiling point (108·54° at 763 mm. pressure) and contains exactly 22·242% of hydrogen chloride

(D 1·0962). By suitable dilution, the requisite standard solutions may then be made. L. DE K.

Estimation of Dissolved Oxygen in Water. WILLEM P. JORISSEN (*Chem. Weekblad*, 1909, 6, 123—125. Compare Winkler, Abstr., 1889, 79; Romyn, Abstr., 1894, ii, 28, and 1896, ii, 579; Jorissen and Ringer, Abstr., 1906, ii, 490).—Experimental data are given in support of the view advanced by Jorissen and Ringer that with sea-water Romyn's method for the estimation of dissolved oxygen yields results which are much too low. A. J. W.

Estimation of Sulphur in Coals and Cokes. M. HOLLIGER (*Zeitsch. angew. Chem.*, 1909, 22, 436—439, 493—497).—A criticism of the various methods proposed from time to time. For the estimation of the total sulphur, a modification of Brunck's method (combustion with cobalt oxide and sodium carbonate in a current of oxygen, Abstr., 1905, ii, 95) is recommended as being the only trustworthy method. The mass instead of being extracted with water is dissolved in hydrochloric acid and evaporated to render the silica insoluble. To the dry mass is added the contents of the Peligot tube, in which any volatilised sulphur has been absorbed, this previously having been neutralised and boiled to expel the excess of hydrogen peroxide. A little hydrochloric acid is now added, and the filtrate is precipitated with barium chloride as usual.

For the estimation of the volatile sulphur, Sauer's method is recommended as the most trustworthy. The process consists in burning the substance in a current of oxygen and absorbing the products of combustion in a suitable oxidising medium. The author has improved the process by filling the front part of the combustion tube with platinum wire cuttings, which are then heated to redness.

L. DE K.

Estimation of Sulphur in Urine. EMIL ABDERHALDEN and CASIMIR FUNK (*Zeitsch. physiol. Chem.*, 1909, 59, 121. Compare this vol., ii, 263).—Reference is made to a paper by Modrakowski (*Zeitsch. physiol. Chem.*, 1903, 38, 362) in which the authors' work has been largely anticipated. W. D. H.

Volumetric Estimation of Sulphurous Acid in Wines [and Food Products]. CHARLES BLAREZ and L. CHELLE (*Ann. Fabrif.*, 1909, 2, 76—79; *Bull. Assoc. Chim. sucr. dist.*, 1909, 26, 690—693).—Two hundred and fifty c.c. of the wine and 2 c.c. of syrupy phosphoric acid are heated in a water-bath under greatly reduced pressure, and the distillate, which contains all the sulphur dioxide, is collected in a receiver containing 20 c.c. of *N*-sodium hydroxide. A slight excess of dilute hydrochloric acid is added, and the liquid is at once titrated with *N*/ 0 iodine, using starch as indicator. If desired, the sulphuric acid formed in the reaction may be estimated gravimetrically.

L. DE K.

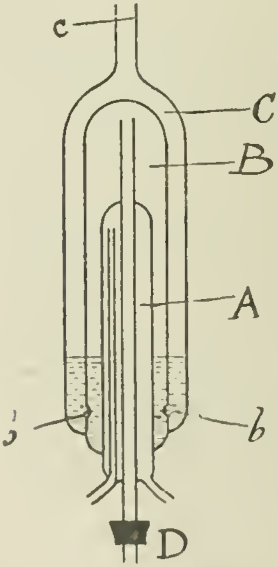
Estimation of Sulphuric Acid as Barium Sulphate. JULIUS F. SACHER (*Chem. Zeit.*, 1909, 33, 218—219).—A criticism of Ruppin's paper (this vol., ii, 180). Pure barium sulphate precipitates are obtained by working with highly diluted solutions, about 0·1 gram of the sulphate in 100 c.c. of liquid; 1% of hydrochloric acid is added, and the solution is heated to boiling. A 3% solution of barium chloride is then added in slight excess with constant stirring. After twenty-four hours, the precipitate is collected and treated as usual.

L. DE K.

Estimation of Sulphuric Acid in the Air of Accumulator Rooms. KARL BECK (*Arb. Kais. Gesund. Amt.*, 1909, 30, 77—80).—The amount of acid was estimated by passing about 100 litres of air in the course of ten to fifteen minutes through a definite quantity of *N*/100 potassium hydroxide solution contained in a specially constructed absorption apparatus, which is figured in the paper, and titrating back the unneutralised alkali with *N*/100 hydrochloric acid, using iodoeosin as indicator, the titration liquid being covered with ether. The quantities of acid found in the accumulator rooms varied between 9·3 and 45·3 mg. of 33% acid per cubic metre of air. S. B. S.

Influence of Chlorides on the Estimation of Nitrates in Water. GUSTAVE PERRIER and L. FARCY (*Bull. Soc. chim.*, 1909, [iv], 5, 178—180).—It is pointed out that in the colorimetric process for the estimation of nitrates in water, devised by Grandval and Lajoux, the addition of the sulphuric acid solution of phenol to the dry residue from the water leads to the evolution of hydrogen chloride when the water under examination contains chlorides. Comparative trials showed that this acid decolorises to a greater or less extent the colouring matter formed and so leads to low results. To avoid this difficulty it is suggested that the standard solution used for the comparison should be prepared, by the addition of sodium chloride, so as to contain the same quantity of chloride as the water under examination.

T. A. H.



Apparatus for Gutzeit's Test. P. B. DALLIMORE (*Pharm. J.*, 1909, [iv], 28, 324).—The apparatus depicted consists of a water condenser, *A*, on which is fused the double jacket, *B* and *C*, communicating with each other by the holes, *b*. Lead acetate solution is poured through *c* and partly fills *B* as well as *C*.

When a flask containing the substance to be tested is attached to *D*, water is circulated through the condenser, *A*, and the gas evolved, passing up *D*, bubbles through the lead acetate solution in *B* and *C*, and finally comes in contact with the mercuric chloride paper fastened on to the outlet, *c*. J. V. E.

Detection of Phosphoric and Phosphorous Acids in Organs. RICHARD EHRENFELD and W. KULKA (*Zeitsch. physiol. Chem.*, 1909, **59**, 43—53).—An aqueous extract of the organ is evaporated to dryness on a water-bath in an atmosphere of carbon dioxide. The residue containing the hypophosphite is moistened with a few drops of hydrochloric acid, again dried, placed in a porcelain boat, and ignited in a stream of hydrogen. Phosphorus trihydride is given off and imparts the characteristic green colour to the flame of the hydrogen.

W. D. H.

Detection and Estimation of Arsenic in Cemetery Soil. CARL MAI (*Pharm. Zentr.-h.*, 1909, **50**, 169—170).—About 200—250 grams of the soil are mixed with sufficient hydrochloric acid, D 1·125, to form a thin paste. One to two grams of potassium chlorate, and, if necessary, a few drops of ferric chloride, are added, and after twenty-four hours the whole is heated for another hour on the water-bath. The solution is filtered, and the residue is washed with water. The filtrate and washings are then precipitated with ammonia, when the iron precipitate will carry down any arsenic present, and it may, for qualitative purposes, be introduced at once into the Marsh apparatus.

For quantitative purposes, the precipitate is dissolved in dilute sulphuric acid and made up to a definite volume. An aliquot part is then treated by the authors' electrolytic process (Abstr., 1905, ii, 284).

When testing disinterred corpses in an advanced state of decomposition for arsenic, the bones should be examined, as these rapidly absorb arsenic. Attention is also called to the occurrence of arsenic in coffin nails, screws, etc.

L. DE K.

Precipitation of Arsenic by Hydrogen Sulphide. LUCIEN L. DE KONINCK (*Bull. Soc. chim. Belg.*, 1909, **23**, 88—93).—In order to precipitate arsenic rapidly and completely as sulphide, it is necessary to reduce the arsenate to arsenite, and this is most effectually done by warming the solution with hydrochloric and hydriodic acids. Instead of hydriodic acid, a solution of potassium or, preferably, ammonium iodide may be used. The hot solution is then treated with hydrogen sulphide.

Sulphur dioxide cannot be recommended as a suitable reducing agent.

L. DE K.

Estimation of Boron. HIPPOLYTE COPAUX and G. BOITEAU (*Bull. Soc. chim.*, 1909, [iv], **5**, 217—225).—Comparison of the three methods in general use for the estimation of boric acid, namely, (1) extraction with ether, (2) isolation as methyl borate, and (3) titration in presence of glycerol, shows that a modified form of the last-mentioned gives the best results. The first method gives approximate results, but is tedious, since at least three extractions with ether have to be made. The second process is simple and trustworthy in cases where it is applicable, but it cannot be used in presence of tungstates. Where it is used, it is recommended that the methyl borate should be collected in a known volume of standard alkali and the boric acid determined by titration in presence of glycerol. The third process, as modified by the authors, is essentially that described previously (Abstr., 1899, ii, 181), but it is now pointed out that the presence of methyl alcohol does not, as then stated, interfere with the end reaction. The process is applicable to borides and borotungstates, and exact details of manipulation required in these and other cases are given in the original. T. A. H.

Use of Quartz Combustion Tubes, especially for the Direct Estimation of Carbon in Steel. BERTRAM BLOUNT and ARTHUR GARFIELD LEVY (*Analyst*, 1909, 34, 88—95).—Tubes of clear silica were found to be well suited for the purpose of organic combustions; they withstand the action of copper oxide, lead chromate, etc., very well, but at temperatures above 900° copper oxide rapidly attacks and destroys quartz tubes. The authors have also used quartz tubes in the estimation of oxygen in copper by fusion in hydrogen. The tube was heated by a furnace similar to that described by Tucker (Abstr., 1907, ii, 842); iridium-platinum foil was wrapped round the tube, and a current of 200 volts was employed, the initial resistance being not less than 25 ohms, which was lowered gradually to about 7 ohms so as to keep the current constant at 6 amperes. For the estimation of carbon in steel, a silica tube can be employed; it is heated by an electric furnace, and special means are provided for supplying the large volume of oxygen which is absorbed as soon as the steel begins to burn. The current of oxygen is drawn through the combustion tube and potash bulbs, and its rate through the latter regulated by means of an exhaust pump; the oxygen is supplied to the other end of the tube through a Y-tube, one arm of which connects through a trap with the open air. At the commencement of the operation, more oxygen is supplied than can be drawn off by the pump, and a portion consequently escapes into the air, but when the steel commences to burn, this escape ceases, and air itself is drawn into the tube along with the oxygen. To ensure complete combustion of the carbon monoxide evolved, the exit end of the combustion tube is packed with platinised quartz, and a supplementary current of oxygen is passed into the tube through a narrow tube which enters at the exit end of the combustion tube and reaches through the platinised quartz. The steel to be burnt is placed in a boat containing a layer of ignited alumina, and injury to the combustion tube by sparks of molten oxide is prevented by enclosing the boat in a piece of iridium-platinum foil rolled into the form of a tube. A piece of silver foil, placed immediately before the boat, protects the rubber stopper from the intense radiation characteristic of quartz tubes. The results obtained by the method differ by less than 0·02% from those given by the solution method, and agree well with each other. W. P. S.

Gravimetric Estimation of Silver as Chromate. FRANK A. GOOCH and ROWLAND S. BOSWORTH (*Amer. J. Sci.*, 1909, 27, 241—244; *Zeitsch. anorg. Chem.*, 1909, 62, 69—73).—A method based on a reversal of the process for the estimation of chromic acid (Abstr., 1908, ii, 737).

Silver may be precipitated quantitatively as chromate by adding a solution of potassium chromate. The silver chromate is collected on a Gooch asbestos filter, and washed first with a weak solution of potassium chromate and then with water. The precipitate is then dried and weighed.

A precipitate more readily collected and washed may be obtained by redissolving the silver chromate in dilute ammonia and re-precipitating by prolonged boiling. Should the silver solution contain free nitric acid, an excess of potassium chromate should be added, more than sufficient to react on the acid. L. DE K.

Separation of the Alkali Earths. ERICH EBLER (*Zeitsch. anal. Chem.*, 1909, 48, 175—179).—The filtrate from the ammonium sulphide group is evaporated to dryness and the residue is heated to expel ammonium salts. The residue is then dissolved in water and a little hydrochloric acid, and precipitated with ammonia and ammonium carbonate; care must be taken to have just sufficient ammonium chloride present to prevent precipitation of magnesium.

The precipitate is dissolved in as little as possible dilute hydrochloric acid, and the barium is then precipitated as chloride by adding 10 vols. of strong hydrochloric acid. The precipitate is collected on a hardened filter and washed with hydrochloric acid. The filtrate is evaporated to dryness and the residue dissolved in water. The strontium is then precipitated with very dilute (0·15%) sulphuric acid, and the calcium is separated as usual with ammonia and a large excess of ammonium oxalate.

The filtrate containing the magnesium may be tested for that metal by placing a drop on an object glass and adding a minute particle of microcosmic salt; the triple phosphate which soon forms may then be recognised under the microscope. If desired, the whole of the magnesium may then be precipitated as usual. L. DE K.

Precipitation of Magnesium as Ammonium Magnesium Arsenate. ERCOLE RAFFA (*Gazzetta*, 1909, 39, i, 154—162. Compare this vol., ii, 183).—The precipitation of magnesium as arsenate has been studied by a similar series of experiments to those made with the phosphate. When the method employed is similar to that of Neubauer for the phosphate (Abstr., 1896, ii, 674), the results are too high, owing to the formation of the salt, $Mg(NH_4)_4(AsO_3)_2$, which yields the meta-arsenate, $Mg(AsO_3)_2$, on ignition.

It is impossible to avoid some reduction of the precipitate during ignition, even when this is carried out in a current of oxygen. The solubility of ammonium magnesium arsenate is also considerable (compare Fages Virgili, Abstr., 1905, ii, 652, 858), even when dilute ammonia is used for washing. Precipitation as arsenate is therefore less accurate as a means of estimating magnesium than precipitation as phosphate. C. H. D.

Rapid Electro-analysis with Stationary Electrodes. JOHN T. STODDARD (*J. Amer. Chem. Soc.*, 1909, 31, 385—390).—*The Gauze Cathode.*—The cathodes are cylinders of platinum gauze (52 mesh to the inch) 3 cm. in diameter and 3 cm. long, and weigh about

12 grams each, and the anodes are cylinders of platinum foil about 0·8 cm. in diameter and 2·5 cm. long, and are placed concentrically within the cathodes. The precipitations are carried out in 80 c.c. beakers with about 50 c.c. of solution. The wires of both electrodes are bent at an angle of a little over 90° so as to rest on the spout of the beaker and allow a watch-glass cover to be used. When precipitation is complete, the solution, without interrupting the current, is drawn off and the cathode is washed with water by the aid of a siphon, the end of which is slipped between the electrodes.

By the use of a powerful current satisfactory results were obtained with (*a*) cadmium nitrate dissolved in solution of potassium cyanide, (*b*) copper sulphate with 7 to 8 drops of nitric acid at 60°, (*c*) nickel sulphate with 1·5 grams of ammonium sulphate and 12—15 c.c. of ammonia, (*d*) silver nitrate with the least excess of potassium cyanide at nearly boiling heat, and (*e*) zinc sulphate with excess of sodium hydroxide, or an insufficiency of the same and addition of potassium cyanide; the solution is heated. The precipitations are complete in fifteen to thirty minutes.

The Mercury Cathode.—A 40—50 c.c. beaker is used with about 40 grams of mercury, and an anode consisting of a flat spiral of platinum wire placed 0·5—1 cm. from the surface of the mercury. The electrode wires are bent as in the case of the precipitation on gauze. A powerful current is employed, and when precipitation is complete, the mercury is washed by the aid of a siphon without interrupting the current. It is then finally washed with alcohol and ether, and dried at a gentle heat.

Satisfactory results were obtained with solutions of cadmium and silver nitrates and copper, nickel, and zinc sulphates; to each were added 5—6 drops of dilute sulphuric acid (1 : 4), except in the case of silver, where nitric acid was used. The precipitations were complete in ten to fifteen minutes.

The strength of the current does not affect the character of the deposited metal, except in the case of silver, where it should not exceed 1·5 ampere when a gauze cathode is employed. L. de K.

Volumetric Estimation of Thallium. Wolf J. Müller (*Chem. Zeit.*, 1909, 33, 297—298).—The oxidised solution in which the excess of permanganate has been destroyed by boiling is diluted to 500 c.c. and mixed with a definite volume (3—6 c.c. in excess) of standard thiosulphate, 25 c.c. of 1% solution of potassium iodide are added, and the liquid is titrated with standard iodine, with starch as indicator. The end point is shown by a decoloration of the previously bright yellow- or orange-coloured liquid; one drop of thiosulphate should cause the original colour to reappear.

One c.c. of thiosulphate = 0·09727 gram of thallium, but in practice it should be taken as 0·09500 so as to obtain accurate results.

L. de K.

Volumetric Estimation of Copper by means of Potassium Iodide. Franz M. Litterscheid (*Chem. Zeit.*, 1908, 33, 263—264).—The solution, which should contain about 0·1 gram of copper in

50 c.c., is made alkaline with ammonia. Should free nitric acid be present, the neutralised liquid is boiled for a minute and then allowed to cool. Eighteen or 20 c.c. of $N/10$ arsenious acid (prepared as usual) are added, and then acetic acid to acid reaction. Crystals of potassium iodide are now added one by one until the characteristic cuprous iodide has formed. After an hour, the whole is made up to 200 c.c., and when settled, the solution is filtered. One hundred c.c. of the filtrate are then mixed with an excess of sodium hydrogen carbonate, and the excess of arsenious acid is titrated with $N/10$ iodine, using starch as indicator. One c.c. of $N/10$ arsenious acid = 0·00636 gram of copper.

L. DE K.

Titration of Copper and Chromium and of Copper, Chromium, and Iron in Admixture. EVA HIBBERT (*J. Soc. Chem. Ind.*, 1909, 28, 190—192).—*Copper and Chromium.*—The copper should be present as a cupric salt and the chromium as a chromate. The joint amount is found by titration with titanous chloride, the excess of which is in turn titrated with standard solution of iron-alum. The copper only may then be estimated by a second titration, after reducing the chromate by means of sulphur dioxide. Or the copper may be removed with hydrogen sulphide and the chromium re-oxidised with hydrogen peroxide and then titrated as described.

Copper, Chromium, and Iron.—The iron should be present as a ferric salt and the chromium as a chromate. A portion of the solution is titrated for the joint metals with titanous chloride until it turns green, potassium thiocyanate is then added, and the titration continued until the red colour has disappeared. A second portion is freed from copper by means of hydrogen sulphide, and the filtrate after being re-oxidised with potassium chlorate and hydrochloric acid is titrated for iron only, using potassium thiocyanate as indicator. A third portion is then treated with sulphur dioxide to reduce the chromate, and the solution after having been re-oxidised with potassium chlorate and hydrochloric acid is titrated for joint copper and iron.

L. DE K.

New Method of Estimating Cuprous Oxide in Copper. GIULIO COFFETTI (*Gazzetta*, 1909, 39, i, 137—143).—The method is based on the solubility of cuprous oxide in ammonia in absence of oxygen, metallic copper being insoluble under these conditions. The weighed sample is introduced into an apparatus of special construction, and a current of hydrogen is passed over it, ammonia gas being admitted after all the air has been expelled. Ammonium hydroxide is then run into the apparatus through a tap funnel, the gas inlet tube being so arranged that the gas bubbles continuously pass through the liquid. When the solution no longer increases in depth of colour, it is siphoned off through a plug of glass wool, the residue washed with a solution of ammonia in recently boiled water, and the operation repeated. The united filtrates are acidified, and the copper estimated electrolytically. A comparison with Hampe's silver nitrate method shows that the new method is equally accurate and much more rapid.

C. H. D.

Method for the Estimation of Mercury in Solutions containing Iodides. Henrik Wegelius and Sulo Kilpi (*Zeitsch. anorg. Chem.*, 1909, 61, 413—416).—In the estimation of mercury in potassium mercuric iodide, the iodine is first removed from the solution by addition of an excess of moist silver chloride. After heating until clear, the solution is filtered and acidified with hydrochloric acid, and the mercury precipitated with hydrogen sulphide.

A reversible colour change of the compound Ag_2HgI_4 at 50° has been observed and is under investigation. C. H. D.

Separation of Iron from the Elements of Groups IV and V and Detection of the Rare Earths in Arable Soils. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. sucr. dist.*, 1909, 26, 694).—The hydrochloric acid solution of the substance is rendered alkaline with aqueous sodium hydroxide or ammonia and an excess of sodium sulphide or ammonium sulphide is added. Acetic acid in fair excess is then added, and the precipitate is collected on a filter and washed with a 2% solution of sodium sulphide in 5% acetic acid. It contains any iron and zinc, whilst the filtrate contains any aluminium, manganese, uranium, glucinum, the rare earths, and the earthy phosphates. L. de K.

New Colour Reaction of Ferrous Salts and Some of its Applications. A. Richaud and Bidot (*J. Pharm. Chim.*, 1909, [vi], 29, 230—234).—When a solution of sodium phosphotungstate, acidified by hydrochloric acid, is added to a solution of a ferrous salt and the liquid is then made alkaline with sodium hydroxide, a sky-blue coloration is produced. The reaction is more delicate than that with potassium ferricyanide, and may be employed for the detection of ferrous iron in urine, milk, gastric juice, mineral waters, etc. All the samples of urine examined gave the colour reaction, but it could not be obtained with blood-serum, so that the test may possibly prove useful in legal cases. No coloration is produced with ferric salts.

T. A. H.

Estimation of Ferrous Oxide in Magnetite. R. B. Gage (*J. Amer. Chem. Soc.*, 1909, 31, 381—385).—0·5 Gram of the sample, which need not be reduced to an impalpable powder, is heated in a platinum crucible with 10 c.c. of hydrofluoric acid and 15 c.c. of dilute sulphuric acid (1 : 3) in a current of carbon dioxide. To prevent bumping, a few coils of platinum wire are introduced. After some five minutes, the decomposition is complete and the crucible and contents are placed in a beaker containing about 400—500 c.c. of recently boiled water. In order to render the hydrofluoric acid harmless, a solution is added, made by dissolving 5 grams of calcium carbonate in 50 c.c. of water and 10 c.c. of 85% ortho-phosphoric acid, and the liquid is then at once titrated for ferrous iron with permanganate. The first permanent colour is taken for the end-point. L. de K.

Examination of Mint Nickel. Willem J. van Heteren and H. van der Waerden (*Chem. Weekblad*, 1909, 6, 157—165).—A rapid electrolytic method for the estimation of nickel in the Dutch standard coinage is described. The alloy contains 75% of copper and 25% of nickel. It was found that the presence of 0·5 gram of ammonium nitrate did not interfere with the deposition of the nickel, but that the presence of larger quantities is to be avoided. Ten grams of the alloy, cut up as finely as possible, are dissolved in a mixture of 15 c.c. of nitric acid (D 1·3), 25 c.c. of sulphuric acid (D 1·8), and 40 c.c. of water. The solution is cooled, diluted with water to 1 litre, and two portions of 100 c.c. each electrolysed for copper at 80° with Winkler's wire gauze cathode. The completion of the precipitation of the copper is determined by introducing into the liquid two platinum wire electrodes connected to an accumulator, the absence of a copper deposit on the cathode indicating the end-point. Without interrupting the current, the copper-covered cathode is then removed, and washed with a minimum quantity of water during the process. To the acid nickel solution are added 50—60 c.c. of ammonium hydroxide (D 0·95) and 5 grams of ammonium sulphate. The volume of the resulting solution should be about 200 c.c. The nickel is deposited at a temperature near the b. p. of the solution, the end-point being determined by Tschugaeff's reagent (Abstr., 1905, ii, 613). The deposition of the copper requires twenty to thirty minutes, and that of the nickel twenty-five to forty minutes. The whole operation can be completed in an hour and a-half, and the results are almost quantitative.

A. J. W.

Separation of Tin and Antimony. LeRoy W. McCay (*J. Amer. Chem. Soc.*, 1909, 31, 373—381).—The process is briefly as follows: the mixed higher sulphides of tin and antimony are redissolved in 5 c.c. of hydrochloric acid, and when the hydrogen sulphide has been expelled, a solution of tartaric acid is added and the filtrate is neutralised with sodium hydroxide. Five c.c. of 48% hydrofluoric acid are added, and then an excess of sodium acetate. The whole is diluted to about 300 c.c., and the antimony precipitated with hydrogen sulphide; the fluoride present prevents the precipitation of the stannic tin. The antimony precipitate is converted as usual into the black anhydrous sulphide.

The filtrate is evaporated in a platinum dish on the water-bath with addition of 20 c.c. of sulphuric acid to expel the fluorine, and, after dissolving the residue in water, the tin is precipitated with hydrogen sulphide and treated in the usual manner. L. de K.

Volumetric Estimation of Titanium, and of Titanium in the Presence of Iron. Eva Hibbert (*J. Soc. Chem. Ind.*, 1909, 28, 189—190).—The titanic salt dissolved in dilute hydrochloric acid is introduced into a flask fitted with a trebly-perforated rubber cork; one of the holes is fitted with a Bunsen valve, through which a platinum wire, having a piece of zinc attached to it, is passed, and the other two holes, *A* and *B*, are temporarily closed with glass rods. In this way the zinc is suspended in the liquid, and when the reduction has lasted for about twenty minutes and the solution has been boiled, the rod is removed from *A* and a current of carbon dioxide is passed;

the rod is then removed also from *B*. After withdrawing the zinc out of the liquid by means of the wire and washing it, the solution is titrated for titanous chloride with standardised solution of methylene-blue, the point of the burette being introduced into the opening *B*.

As ferrous chloride does not react with that reagent, the method is also applicable in presence of iron. An aliquot part of the original solution is then titrated for ferric iron with standard titanous chloride.

L. DE K.

Estimation of Thorium in Monazite Sand. OTTO HAUSER and FRITZ WIRTH (*Zeitsch. angew. Chem.*, 1909, 22, 484—487).—A modification of Borelli's method (*ibid.*, 21, 2275). Fifteen to twenty grams of the finely-powdered sample are boiled with strong sulphuric acid for several hours, and the bulk of the acid is then expelled by heating. When cold, the residue is treated with a litre of 4—5% hydrochloric acid. After removing any lead, the filtrate is mixed in the cold with an excess of oxalic acid, and after the precipitate has settled, it is collected on a filter. The oxalates are heated with nitric acid and a few drops of weak permanganate, or else ignited and dissolved in hydrochloric acid, and the thorium is then precipitated by boiling with sodium thiosulphate, which operation is repeated in order to get a perfectly pure precipitate. L. DE K.

The Opening-up of Minerals Containing Tantalum, Niobium, and Titanium. WILLIAM B. GILES (*Chem. News*, 1909, 99, 1—4, 25—27).—The powdered mineral is mixed with two and a-quarter parts of potassium carbonate and introduced into a steel crucible fitted with a lid, which is in turn placed in a plumbago crucible also fitted with a cover, which is then filled up partly with powdered and partly with lumps of wood charcoal. After placing the whole in a furnace and exposing it for an hour to a most intense heat, the mass, owing to the action of the reducing gases, will contain the heavier metals, either as such (tin, copper) or else as lower oxides (iron, manganese), whilst the tantalum and niobium may be extracted as soluble potassium compounds with water. The solution is then treated as usual for their separation.

The insoluble matter contains the titanium and any zirconium present in the mineral, but in accurate analysis it should also be tested again for tantalum and niobium. L. DE K.

A Reaction of Gold Chloride. DAUVÉ (*J. Pharm. Chim.*, 1909, [vi], 29, 241).—When a piece of aluminium foil is placed in a solution of auric chloride in water, colloidal gold is formed after some hours, and the liquid presents an appearance similar to that obtained by immersing zinc foil in a solution containing auric chloride, ferric chloride, and arsenic acid (Carnot, Abstr., 1884, 115). The gold is simply replaced by the aluminium, no colloidal gold being formed if aluminium chloride is first added to the auric chloride solution.

T. A. H.

Messina Oils. Analysis of the Oils of Lemon, Orange, and Bergamot. ENRICO BERTÉ and ROMEO (*Chemist and Druggist*, 1909, 74, 81).—The analyses of the oils of lemon, orange, and bergamot tabulated in this paper were carried out under the auspices of the Messina Chamber of Commerce. The citral in lemon oil was estimated by Romeo's method, which consists in titrating the alkali liberated in contact with sodium sulphite in presence of potassium hydrogen sulphite. The sp. gr., optical rotation, and initial boiling point of the oils were ascertained, and the properties of some of the possible adulterants are also given. Of these, the most difficult to detect is Grecian turpentine from *Pinus halepensis*; the physical constants of this oil were determined in detail: D^{15} 0·8620—0·8718; $[\alpha]_D$ 37°6′ to 39°45′; b. p. 155°; fixed residue, 2·75%; acid value, 0·17%; solubility in 80% alcohol, 1 vol. in 13·7. G. T. M.

Sensitive, New Reactions for Detection and Identification of Glycerol. GEORGES DENIGÈS (*Compt. rend.*, 1909, 148, 570—572. Compare this vol., ii, 272, 273).—The colour reactions previously studied in connexion with dihydroxyacetone furnish a convenient and delicate test for glycerol. To oxidise glycerol to dihydroxyacetone, the following procedure is adopted. 0·08—0·1 Gram of glycerol is placed in a test-tube with 10 c.c. of bromine water freshly prepared by dissolving 0·3 c.c. of bromine (exactly measured) in 100 c.c. of distilled water. The mixture is heated on the water-bath for twenty minutes and then boiled to expel bromine. The tests already described are now applied to portions (0·4 c.c.) of this solution.

Other reactions suitable for the detection of glycerol, depending on the formation of glycerosazone and the osazone of methylglyoxal, are described. W. O. W.

Estimation of Phenol. LUIGI MASCARELLI (*Gazzetta*, 1909, 39, i, 180—189).—The various methods proposed for the estimation of phenol are reviewed. In the precipitation by means of bromine, the precipitate is tribromophenol, even when an excess of bromine (dissolved in sodium bromide and bromate) is added. The precipitation is practically complete (error, 0·77—0·89%) and is unaffected by the presence of other compounds which react with bromine. C. H. D.

Detection of Methylpentoses in Presence of Pentoses. LEOPOLD ROSENTHALER (*Zeitsch. anal. Chem.*, 1909, 48, 165—172).—The tests for methylpentoses now used are applied to the hydrochloric acid distillates. By simply heating the methylpentoses with hydrochloric acid, D 1·19, for a few minutes in the boiling water-bath, a liquid is obtained showing a characteristic spectrum even in presence of pentoses. The following method, however, is preferable. A little of the substance is heated in the boiling water-bath for ten minutes with 10 c.c. of fuming hydrochloric acid and 1—2 c.c. of pure acetone. The red solution when examined spectroscopically exhibits a sharp absorption band in the yellow which covers the *D*-line, and slightly extends to the right and the left. The red colouring is insoluble in most of the immiscible solvents, but dissolves readily in creosote and guaiacol.

In order to detect pentoses in presence of methylpentoses the hydrochloric acid distillate should be tested for furfuraldehyde as follows. An equal volume of fuming hydrochloric acid and a few crystals of resorcinol are added, and the liquid is examined in the spectroscope. Large portions of the right side of the spectrum are obscured, but soon an absorption line in the red appears, which, increasing in width, soon occupies half of the still clear space. In presence of but little furfuraldehyde, the line situated between *C* and *D* is very conspicuous. If the solution darkens and a precipitate forms, this is filtered off, washed with water, and redissolved in glacial acetic acid, which, after being diluted with water, again shows the absorption band between *C* and *D*.

A large number of gums, gum-resins, and glucosides have been tested, and the results are given in a table. L. DE K.

Estimation of the Various Sugars Occurring Together in Diabetic Urines. H. CHRISTIAN GEELMUYDEN (*Zeitsch. anal. Chem.*, 1909, 48, 137—163).—A lengthy paper containing a large number of mathematical formulæ and three tables.

The process, which aims at the estimation of dextrose, maltose, lævulose, etc., is carried out by means of titration (by Knapp's mercury solution) before and after inversion and by polarisation. Advantage is also taken of the fact that certain yeast cultures act only on mono-, but not on di-saccharides. L. DE K.

Estimation of Sugar in Meat. EMIL BAUR (*Arb. Kais. Gesund. Amt.*, 1909, 30, 63—73).—The method is an adaptation of the Molisch-Udransky test for sugars for purposes of quantitative analysis. One c.c. of the liquid to be tested is allowed to drop into the bottom of a test-tube with a ground stopper. To this are added 9 c.c. of pure sulphuric acid, and then 8—10 drops of alcoholic thymol solution containing 15 grams of thymol in 100 c.c. The contents of the test-tube are then mixed, and left for half an hour. By measuring the breadth of the absorption band due to the coloured product of the reaction, the amount of sugar present can be ascertained after having determined once the breadth of the band corresponding with the various concentrations of sugar. The solution used for the test must be diluted sufficiently to give a measurable band. The method of applying the reaction to estimation of sugar in meat and urine is described. The total carbohydrates, and not the dextrose alone, were determined by this method.

S. B. S.

Estimation of Glycogen. BERNHARD SCHÖNDORFF, PETER JUNKERSDORF, and VICTOR HESSEN (*Pflüger's Archiv*, 1909, 126, 578—581); B. SCHÖNDORFF, P. JUNKERSDORF, and PAUL HEYDEN (*ibid.*, 582—584).—In the estimation of glycogen in liver and muscle by the potash method, the yield is the same whether the boiling with potassium hydroxide (30%) is continued for thirty minutes, one, two, or three hours.

If the potassium hydroxide is of less concentration, the full yield is not obtained. W. D. H.

Micro-chemical Detection of Glycogen. Max Bleibtreu (*Pflüger's Archiv*, 1909, 127, 118—124); Kan Kato (*ibid.*, 125—142).—The micro-chemical test for glycogen in tissues if negative does not prove absence of glycogen without a chemical analysis. The frog's ovary, for instance, contains glycogen, but does not respond to the microscopic test with iodine, probably because the glycogen enters into combination with some tissue constituent. The following test is proposed as more trustworthy as a micro-chemical reaction. The section is placed on a slide in a drop of water and alcohol, and a crystal of potassium ferricyanide added until the liquid is yellowish-green, and then a crystal of potassium iodide; the fluid is then allowed to pass over the section, and the excess taken up with blotting-paper; it is then mounted in a drop of syrup of either lævulose or achroodextrin, and the glycogen reaction can then be seen. W. D. H.

Estimation of Formic Acid in Fruit Juices. F. Schwarz and O. Weber (*Zeitsch. Nahr. Genussm.*, 1909, 17, 194—197).—As preparations containing formic acid are now sold and used for the preservation of fruit juices, the authors describe the following method for the estimation of this acid. Shortly, the process consists in separating the formic and other volatile acids by distillation, titrating the distillate, and re-distilling after removing the formic acid by oxidation. The difference in the amount of acidity of the two distillates gives the amount of the formic acid. Fifty grams of the sample of fruit juice are steam-distilled until 400 c.c. of distillate have been collected; if superheated steam is used, it is only necessary to collect 250 c.c. of distillate. The distillate is then titrated with *N*/10 alkali solution, using phenolphthalein as indicator, and the neutral solution is evaporated to dryness in order to remove the alcohol which is present in small quantity in most fruit-juices; the addition of the indicator also introduces a little alcohol. The residue is dissolved in 20 c.c. of water and 30 c.c. of a solution, containing 12 grams of potassium dichromate, 30 c.c. of concentrated sulphuric acid, and 100 c.c. of water, are added. The mixture is boiled for ten minutes in a reflux apparatus and then steam distilled, the same volume of distillate being collected as in the first distillation. The distillate is titrated as before, and the difference in the two titrations is a measure of the formic acid which has been removed by the oxidation. Experimental evidence is given showing that the process is trustworthy.
W. P. S.

Volumetric Estimation of Formic Acid and its Salts. Friedrich Auerbach and Werner Plüddemann (*Arb. Kais. Gesund. Amt.*, 1909, 30, 178—194).—The method is based on the reduction of mercuric chloride by formic acid or formates according to the equation $2HgCl_2 + H{\cdot}CO_2H = Hg_2Cl_2 + CO_2 + 2HCl$. This reaction proceeds to completion if the concentration of hydrogen ions is not too great, and this is prevented by carrying out the reaction in presence of a sufficient quantity of sodium acetate. Mercuric chloride solution of known concentration is used, and the amount of formic acid present can be determined by estimating the quantity of mercuric salt still present after filtration from the precipitated mercurous salt. This can be effected by titration with potassium iodide: $HgCl_2 + 4KI = HgI_2,2KI$. The double iodide remains in solution until mercuric chloride is in excess, when the red mercuric iodide commences to separate. This happens, however, before the quantity of mercuric salt corresponding with the above equation has been added, owing to a secondary reaction: $HgI_2,2KI + HgCl_2 \rightarrow 2HgI_2 + 2KCl$, which depends on the relative concentrations of the salts in solution. The error due to this factor can be eliminated by titrating the mercuric salt into a definite quantity of potassium iodide solution of a certain standard strength. The deviations from the true stoicheiometric relations having been once experimentally determined for this particular quantity of solution of given strength and tabulated, it is easy to estimate the amount of mercuric chloride in any solution. S. B. S.

The Chemistry of Vinegar and the Methods of Investigation. JOHANNES BRODE and WILHELM LANGE (*Arb. Kais. Gesund. Amt.*, 1909, 30, 1—54).—The concentration of the hydrogen ions at the points of change of colour of the various indicators, both at the ordinary temperature and on warming, were determined, using normal solutions with known concentration of hydrogen ions, such as hydrochloric acid solutions of given strengths, acetic acid, mixtures of acetic acid and sodium acetate, of disodium and monosodium phosphates, of ammonia and ammonium chloride, and of sodium hydroxide. The results were compared with numbers obtained by Salm, Friedenthal, Salessky, and Fels. The results were applied to the titration of vinegars. It was found that the free mineral acids could be estimated accurately by diluting with an equal volume of alcohol and titrating in the presence of methyl-orange according to Schidrowitz's method. In this solution the concentration of hydrogen ions due to the acetic acid dissociation is negligible. The estimation of acid by the sugar inversion method was also tried, but was not so satisfactory as the indicator method, owing to the fact that tartaric acid acts as a weaker acid in this respect than acetic acid.

The methods used for estimation of other substances in vinegar were also subjected to examination by the authors. A modification of the Zeisel-Fanto method (conversion into *iso*propyl iodide) is recommended for the estimation of glycerol. Details are also given in the paper for estimation in the extractives of oxalic acid, boric acid, heavy metals, and salicylic and benzoic acids. The processes are all based on known methods. S. B. S.

Action of Light on Milk Preserved with Potassium Dichromate. ALBERT GASCARD (*Compt. rend.*, 1909, 148, 580—582).—The compulsory addition of potassium dichromate to milk intended for analysis is objectionable for various reasons, but the objections may be minimised by keeping the sample in the dark. G. B.

General and Physical Chemistry.

Solubility Determinations with the Refractometer. FREDERICK H. GETMAN and F. B. WILSON (*Amer. Chem. J.*, 1909, 41, 344—348).—Osaka has shown that the relation between the angles of refraction of a mixture and its components may be expressed by the equation $ax + bx^2 = \delta - \delta^1$, in which δ and δ^1 represent the angles directly observed on the divided circle of the refractometer for the solvent and the solution, x the quantity of solute in grams per 100 c.c., and a and b are constants. This equation has been tested by the data obtained for aqueous solutions of potassium chloride, bromide, iodide, nitrate, and chromate, and also of sucrose. The calculated values of x are only in approximate agreement with the experimental values. The simpler equation $ax = N_s - N_w$, in which a is a constant and N_s and N_w are the refractive indices of the solution and the solvent respectively, expresses the experimental data equally well.

H. M. D.

Anomalous Dispersion of Light in Metallic Vapours. HERMANN GEISLER (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 89—112).—The experiments were undertaken in order to find whether Kirchhoff's law regarding emission and absorption holds for the spectra of metallic vapours. The method depends on observing whether the emission lines show anomalous dispersion. Absorption and anomalous dispersion are intimately connected, and if anomalous dispersion is observed, it follows that the lines also suffer absorption.

The apparatus consisted of a combination of a Jamin's interference refractor and a grating. The material (metal or salt) used to produce the vapour was inserted in the positive carbon of the arc, and from the effect of the vapours on the fringes, registered photographically, the occurrence of anomalous dispersion could be decided. Practically all the common metals, and some rare metals, were investigated in this way, and the bands and lines for which anomalous dispersion was observed are given in tabular form as well as the approximate intensity of the dispersion. Anomalous dispersion was observed in a very large number of cases, and it is considered probable that under suitable conditions all the lines would show this phenomenon, proving the qualitative validity of Kirchhoff's law in this case. The lines also show great differences in the degree of anomalous dispersion, the strongest lines generally showing the greatest anomaly, but the results are not sufficient to show whether Kirchhoff's law holds quantitatively for the spectra of metallic vapours.

A bibliography of the subject is given. G. S.

The Spectra of Spark Discharges in Liquids. HEINRICH KONEN and HERMANN FINGER (*Zeitsch. Elektrochem.*, 1909, 15, 165—169).—The spectra of spark discharges between metals under water are studied; twenty-one different metals are used. Compared with the spectra in air, the air lines are entirely absent; a strong, continuous spectrum is often, but not always, superposed on the spectrum of the metal. The lines of hydrogen and oxygen are not present, or those of salts dissolved in the water. The lines observed in air are sometimes absent, sometimes enhanced, broadened or reversed, but details are not given. As a general rule, lines belonging to a series behave in the same way. T. E.

Two New Arrangements for producing Emission Spectra. Rudolf Krulla (*Zeitsch. physikal. Chem.*, 1909, 66, 78—80.)—Two pieces of apparatus for the production of emission spectra, in which both electrodes consist of a solution of the metallic salt, are described and figured. The first arrangement consists of a dropping-funnel and doubly-bent U-tube, each of which contains the salt solution and a platinum wire (for conveying the current) sealed through the glass and in contact with the solution. The spark passes between a falling drop and the top of the salt solution in the U-tube. The second apparatus consists of two funnels with sealed-in platinum wires; the capillary ends of the funnels are so bent that the out-flowing salt solution forms two thin streams which cross each other, and the spark passes at the point where the streams are most nearly in contact. G. S.

Influence of Temperature on the Emissive Power of Metals. E. Hagen and Heinrich Rubens (*Sitzungsber. K. Akad. Wiss. Berlin*, 1909, 478—492).—Whilst the optical constants of metals in the visible spectrum are little affected by temperature, in the infra-red region, as demanded by the electro-magnetic theory, the variation with temperature is large.

The metals used in these experiments were silver, platinum, and nickel, and the alloys brass, platinum-silver, constantan, and nickel steel. Instead of comparing the emissive power of the polished surface in each case with that of a black body for the same temperature and wave-length, it was found better to examine the variation with temperature of the metal and of the black body (a hollow copper vessel blackened with cobalt oxide) separately, comparing the curves thus obtained. The metals were heated in dry nitrogen by an electric furnace. The rays examined were the residual rays after four reflexions from fluorite (26·0 μ), and after three reflexions from quartz (8·85 μ, the rays of 20·75 μ, also present, being absorbed by a plate of fluorite).

The relation $\nu = 36{\cdot}5\sqrt{(\sigma/\lambda)}$, where ν is the emissive power, σ the electrical resistance, and λ the wave-length, is found to hold good very accurately for all the metals and alloys examined, and for both sets of rays. The emissive power of platinum increases with the temperature at a slightly faster than the calculated rate. Nickel shows an inflexion of the curve at 320°, the magnetic critical point. Alloys with a small temperature-coefficient of resistance, such as constantan, approach the black body in their optical behaviour.

The region in which the optical temperature-coefficients of the metals first coincide with the electrical must lie between $\lambda = 0{\cdot}7\ \mu$ and 8·85 μ. C. H. D.

Secondary Spectrum of Hydrogen. C. F. Hogley (*Phil. Mag.*, 1909, [vi], 17, 581—583).—A vacuum tube containing hydrogen was connected with a bulb containing charcoal. On cooling this in liquid air, the intensity of the lines was seen to decrease, but the relative intensities of the two spectra remained unchanged until the entire spectrum had disappeared, and discharge would no longer take place on account of the high degree of exhaustion. The observations indicate that hydrogen is really the source of the secondary spectrum.

H. M. D.

Red Region of the Arc Spectra of Nickel, Cobalt, and Chromium. Leander Stüting (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 73—88).—The arc was passed between rods of the metals themselves; the spectra were obtained by means of a concave grating, and photographed on the special colour-sensitive plates of Wratten and Wainwright. The wave-lengths of the lines, their relative intensity, and the probable error of the measurements are given in tabular form for the three metals in question, and the lines measured by previous observers are also given. In the case of chromium there are a number of bands as well as lines, and the positions of the heads of five groups of bands are given. Whether the bands belong to the metal or to its oxide has not been definitely determined.

G. S.

Demonstration of the Absorption of Colourless Solutions in the Ultra-violet. Carl Schall (*Zeitsch. physikal. chem. Unterr.*, 1908, 21, 389—390).—In a previous paper (compare Abstr., 1908, ii, 139) the preparation of a test-paper has been described which turns blue in ultra-violet light, but does not alter in diffused daylight. This paper may be used to show differences of absorption in the ultra-violet as follows. A trough, the front and back of which are made of transparent quartz, is partly filled with alcohol, and along with a second (empty) trough of glass is set up in front of a sheet of the test-paper in question; the troughs and paper are then exposed, at a distance of 4 cm., to the light from a Heraeus lamp. After a few minutes, white silhouettes of the troughs on a blue background are observed on the paper; only where the rays of short wave-length meet air, alcohol, or quartz have they penetrated sufficiently to produce colour. If instead of alcohol, a concentrated solution of naphthalene in the latter solvent is used in the quartz trough, a completely white image of the trough is obtained, as naphthalene absorbs the ultra-violet rays.

G. S.

Absorption Spectra of Solutions of a Number of Salts in Water, in Certain Non-aqueous Solvents, and in Mixtures of these Solvents with Water. XXIV. Harry C. Jones and John A. Anderson (*Amer. Chem. J.*, 1909, 41, 163—208, 276—326. Compare Abstr., 1907, ii, 147, 211, and 212).—The authors have obtained photographic records of the absorption spectra of solutions of cobalt chloride, bromide, nitrate, sulphate, thiocyanate, and acetate, and of nickel, cupric, ferric, and chromic chlorides. In certain cases, solutions in methyl alcohol, ethyl alcohol, and acetone, as well as in water, were examined, and the effect of the addition of dehydrating agents, like calcium and aluminium chlorides, was studied.

With the object of ascertaining what components of the solutions give rise to the various absorption bands, comparative measurements were made in such a way (1) that the product of depth of layer and concentration remained constant; (2) that the total number of undissociated molecules in the path of the beam of light was constant; (3) that the total number of ions was constant.

The ultra-violet absorption exhibited by aqueous solutions of cobalt salts diminishes with dilution, and increases with rise of temperature; this is consistent with the view that this band with its middle at about $\lambda = 3300$ is due to a relatively simple hydrate. The absorption band in the green, which is exhibited by all solutions, is probably due to the cobalt atom, the absorbing power of which is modified to some extent by the atoms or groups with which it is in combination. The absorption in the red, which is much more intense in the non-aqueous solutions, and increases when we pass from methyl alcohol to ethyl alcohol, and from this to acetone, is supposed to be due to relatively simple combinations of the cobalt salt with water or other solvent molecules.

The absorption bands of nickel chloride appear to be very similar in their behaviour to the green band of cobalt, and are therefore probably due to the nickel atom.

In the case of cupric chloride, the photographic records indicate that the absorption band in the red is due to the copper atom, and that in the ultra-violet to simple combination of the salt with the solvent.

The variations in the three absorption bands of solutions of chromic chloride indicate that these are due to chromium atoms, whether these are present in the solution as ions, or are combined with other atoms in the form of molecules.

Photographic records of the absorption spectra of solutions of salts of neodymium, praseodymium, and erbium have been obtained. The influence of concentration and of the nature of the solvent on the absorption spectrum was investigated in a manner similar to that previously described for salts of cobalt. The results obtained are considered to furnish strong evidence in favour of the view that compounds are formed between the solute and solvent molecules.

In particular, it may be noted that the absorption spectra of aqueous solutions of the chloride and bromide of neodymium change very little with the concentration. Concentrated solutions of the nitrate show a somewhat different spectrum, but with diminishing concentration the spectrum changes so as to become more nearly identical with the spectra of the chloride and bromide. The addition of large quantities of calcium or aluminium chloride to a solution of neodymium chloride has but little effect on the spectrum. In non-aqueous solvents the spectra of the different salts are different, and the spectrum of any one salt varies with the nature of the solvent. When neodymium chloride is dissolved in mixtures of water and methyl or ethyl alcohol, and the relative proportion of the two solvents is varied, there is no marked change in the spectrum until the percentage of water falls to 15 or 20. On further reduction of the proportion of water, the solution gives a spectrum which consists of the spectra for the aqueous and non-aqueous solutions superposed; the former decreases and the latter increases in intensity as the proportion of water in the mixture is diminished. Praseodymium chloride behaves similarly to the neodymium salt, except that the alcoholic solutions show a band in the ultra-violet which has no analogue in the aqueous solution.

The observations lead to the view that both molecules and ions of the dissolved salts form compounds with molecules of the solvent.

H. M. D.

Fluorescent Substances Contained in Water. F. Dienert (*Bull. Soc. chim.*, 1909, [iv], 5, 326—329).—Water in white glass phials of 45 c.c. capacity is strongly illuminated by the concentrated beam from an arc, and is viewed from the side through a crystal of doubly refracting material. Since light reflected from suspended particles is polarised, the principal image consists of reflected as well as fluorescent light, whereas the extraordinary image is entirely of fluorescent light.

By employing light of various colours, the test for fluorescence is often rendered more delicate, and it is possible to distinguish between one fluorescent substance and another. The presence of one part of æsculin in 200,000,000 parts of water could only be detected in violet light, whilst fluorescein is more readily detected in white light.

The author has found at least three distinct fluorescent substances in natural waters. Deep well-water contains a greenish, fluorescing substance, destroyed by light or by acid, like fluorescein, but not by boiling. Surface-waters, particularly of peaty or sewage-contaminated origin, contain a greenish-blue, fluorescent substance, more resistant to light and acid than the preceding. This substance is greenish in blue light, in which spring-waters give a fluorescence equivalent to a 1 in 20,000,000 solution of æsculin. A third fluorescent substance, which is found in town fogs, rain, and snow-waters, is somewhat more bluish.

R. J. C.

Processes Used to Measure the Fluorescence of Waters. F. Dienert (*Bull. Soc. chim.*, 1909, [iv], 5, 330—332).—The water under examination is illuminated and matched with a standard solution of æsculin or a standard fluorescent spring-water, the solutions being simultaneously observed through the same birefringent crystal. If the fluorescence is strong, the beam of light may be roughly split into two, and a more accurate method followed of substituting a standard solution for the unknown solution, matching each with a second standard.

R. J. C.

The So-called Asymmetry Product. II. Emil Bose and Fr. A. Willers (*Zeitsch. physikal. Chem.*, 1909, 65, 702—726. Compare this vol., ii, 2).—Instead of Guye's form of the asymmetry product, a simpler form without denominator, of the type $R = (C_1 - C_2)(C_1 - C_3)(C_1 - C_4)(C_2 - C_3)(C_2 - C_4)(C_3 - C_4)$, appears to possess certain advantages as a representation of optical rotatory power. The formula is tested by the available data as to the rotatory power of forty-two pure non-associated substances (esters), the molecular rotatory power being represented both by the usual formula, $M[a] = Ma/ld$, and by the alternative formula, $a/l. \sqrt{M/d}$, where the symbols have the usual significance. The results of the calculations are given in tabular form, and completely disprove the theory that the rotatory power is determined by the masses of the substituting groups. From the available data other constants are calculated for the substituting groups (seventeen in all) by an approximate method, both expressions for the molecular rotatory power being taken into account, and it is shown that these constants represent the experimental results much more accurately than the mass constants in the asymmetry formula.

G. S.

Electrical Method for Measuring the Changes Produced in Chromate-Gelatin Films by Light. HANS MAYER (*Zeitsch. physikal. Chem.*, 1909, 66, 33—70).—The chromate mixture with which the plates were covered was prepared by warming together 96 grams of distilled water, 4 grams of soft "emulsion" gelatin, and 0·5 gram of potassium dichromate. The dried plates were provided at the ends with electrodes of tin foil, and the resistance of the film under varying conditions as to illumination and temperature determined with a condenser and ballistic galvanometer. The resistance is greatly influenced by moisture, and the film was therefore provided with a varnished glass cover in order to obtain comparable results. The arrangements used in keeping the temperature constant and in measuring the light intensity are fully described.

In measuring the effect of illumination, the plate was exposed to diffused daylight. The conductivity diminishes considerably on exposure to light, the change being progressive with time of exposure. Even when again placed in the dark, the change proceeds for some time as when exposed. The conductivity, both for the illuminated and unilluminated plates, increases rapidly with the temperature, but the temperature-coefficients in the two cases are not the same. When a fresh plate is exposed to light and again placed in the dark, the resistance does not return to its original value. The percentage alteration of the conductivity brought about by illumination is independent of the original value of the conductivity (before illumination), and is therefore a characteristic property of the system. The sensitiveness of the gelatin to light diminishes with age, rapidly at first, and then more slowly.

The nature of the chemical changes taking place on the plate are discussed on the basis of Hardy's theory of colloid coagulation, but no final conclusions have been drawn. The investigation is being continued.

G. S.

Electrochemistry of Light. V. WILDER D. BANCROFT. (*J. Physical Chem.*, 1909, 13, 181—250. Compare this vol., ii, 200).—A further compilation of extracts from papers on the problem of solarisation. R. J. C.

Radioactivity of the Thermal Springs of Bagnères-de-Luchon. Charles Moureu and Adolphe Lepape (*Compt. rend.*, 1909, **148**, 834—837).—Of twenty different springs at Bagnères-de-Luchon, only five exhibit spontaneous evolution of gas, the radioactivity of 10 litres of the latter, expressed in milligram-minutes of radium emanation, varying from 4·19 to 18·36. The waters vary in radioactivity from zero to 2·20, ten of them giving values above 0·50. T. H. P.

Radioactivity of the Mineral Springs of Switzerland. Emanation Content of the Water. I. Alfred Schweitzer (*Arch. sci. phys. nat.*, 1909, [iv], **27**, 256—274).—Measurements have been made of the amount of emanation which is present in the water of a large number of springs. In order to avoid the loss of radioactivity which is involved in transport of the water, the measurements were all made at the source. For each water examined, the chemical nature, the geological formation in which it originates, the temperature, and the activity in Mache units are recorded. Three only contain a large proportion of emanation, these being the mineral waters of Disentis, Lavey, and Solis. H. M. D.

Radioactivity of the Atmosphere. Albert Gockel (*Arch. sci. phys. nat.*, 1909, **27**, 248—255. Compare Gockel and Wulf, this vol., ii, 109).—The relative proportion of thorium and radium emanation in the atmosphere at different places has been examined. Observations were made at Fribourg, at the summit of the Rothorn (2300 metres above sea-level), in the neighbourhood of Zermatt (2600 metres) and of the Matterhorn (3000—3300 metres). At Fribourg, the ratio of the quantity of thorium emanation to that of radium emanation in the atmosphere varies from 0·4 to 0·7; the ratio is a little smaller on the Rothorn. On the other hand, the ratio at Zermatt and on the Matterhorn varies from 0·03 to 0·1. The latter result is due to the fact that the neighbouring glaciers do not give off an emanation. Observations relating to the activity of the air extracted from the soil at Fribourg and to that of rain-water and the water obtained from hail, snow, and ice are also recorded. H. M. D.

Action of Radium and Ultra-violet Rays on the Colours of Minerals. Cornelio Doelter (*Monatsh.*, 1909, **30**, 179—229. Compare this vol., ii, 109; Simon, Abstr., 1908, ii, 954).—A record of a large number of observations relating to the changes in colour of various minerals and coloured glasses on exposure to the action of radium rays and ultra-violet light.

It follows from the results obtained that, generally speaking, the colouring materials of minerals are not of an organic nature; the colours are due principally to the presence of oxides of iron, chromium, and manganese.

The change in colour under the influence of radium rays is in many cases the outcome of a reducing action. The ultra-violet rays, on the contrary, have an oxidising action ; consequently, ultra-violet light and radium rays frequently induce opposite changes.

The bearing of the results on the origin of the colour of many minerals and precious stones is discussed. W. H. G.

Decomposition of Water by Radium Salts. ANDRÉ DEBIERNE (*Compt. rend.*, 1909, **148**, 703—705).—The author has made frequent measurements of the rate of decomposition of water by radium salts ranging over considerable periods of time, and finds that the rate remains constant. In the course of an enquiry as to whether the decomposition of water is due to radium, the emanation, or later disintegration products, or to the radiations emitted, it has been found that the action is brought about by radium chloride contained in a sealed glass tube.

The β- and γ-rays are therefore capable of decomposing water, and it is calculated that about 1% of the absorbed radiant energy appears in the form of chemical energy. H. M. D.

Chemical Action of the Penetrating Radium Rays on Water. MIROSLAW KERNBAUM (*Compt. rend.*, 1909, **148**, 705—706. Compare preceding abstract).—The gaseous product obtained by the action of the β- and γ-rays from radium on water has been examined. About 200 cubic millimetres of gas were collected and found to consist almost entirely of hydrogen. On addition of potassium iodide to the water, from which the gas had been liberated, iodine was set free, and the author considers that hydrogen peroxide had been formed. H. M. D.

Ionisation Phenomena due to Snow. K. BERGWITZ (*Jahrb. Radioaktiv. Electronik.*, 1909, **6**, 11—12).—Experiments are described which indicate that the ionisation produced in air which has been passed through a layer of snow is due to the active products radium-*A*, -*B*, and -*C*, which have been formed from radium emanation in the atmosphere and removed by the falling snow. The observations are opposed to the view of Costanzo and Negro (Abstr., 1908, ii, 551), according to which the current of air liberates the ions which acted as condensation nuclei in the formation of the snow flakes.

H. M. D.

Velocity of the Cathode Rays Ejected by Substances Exposed to the γ-Rays of Radium. R. D. KLEEMAN (*Proc. Roy. Soc*, 1909, *A*, **82**, 128—145. Compare Abstr., 1907, ii, 923).—In one series of experiments the scattering of the cathode particles produced by different thicknesses of metal-foil placed in the path of the rays was measured ; in another series, in which the velocity of the rays was investigated, the cathode rays were deflected into an ionisation chamber by an electro-magnet, and the ionisation in the chamber measured for magnetic fields of different strengths. The results show that part of the cathode radiation from a plate exposed to the γ-rays consists of very soft rays, which are absorbed in 1—2 cm. of air ; the softness is practically independent of the thickness of the radiator. The radiation is softer on the side of the plate where the γ-rays emerge than on the side where they enter, and in the latter case the softness of the radiation is independent of the nature of the radiator, as shown by experiments with lead, tin, zinc, copper, iron, and other elements. The soft radiation produced by the β- and γ-rays of radium together is more penetrating than that produced by the γ-rays alone.

The penetrating cathode rays produced directly by the γ-rays are of different velocities. Their velocity, as determined by comparison under the same conditions, is approximately equal to that of the β-rays of radium. G. S.

Secondary γ-Radiation. John P. V. Madsen (*Phil. Mag.*, 1909, [vi], 17, 423—447).—The γ-rays of radium, carefully purified from β-radiation, were allowed to impinge on plates of various metals, and the quantity and absorption coefficient of the secondary γ-radiation emitted on both sides of the plates were determined. There is a marked lack of symmetry in the amounts of secondary γ-radiation emitted from the two sides, and in some cases a difference in the quality of the radiation.

The nature of the incidence (reflected) and emergence secondary γ-radiation depends on (1) the hardness of the primary γ-rays, (2) the metal employed as radiator, (3) the thickness of the radiator. With the most favourable thickness of metal, the secondary emergence radiation from zinc and aluminium is much more than from lead, but of a softer average character. Incidence (reflected) secondary γ-rays are less in amount and softer than emergence rays, and are also much less from lead than from zinc, aluminium, or carbon. It is supposed that much of the reflected γ-radiation from lead is of so soft a character that it is unable to penetrate into the electroscope.

The theory is put forward that the γ-rays of radium and, possibly, of thorium, consist of two distinct homogeneous bundles, the absorption value (λ/Δ) of the softer rays being approximately four times that of the harder rays whatever the absorbing material may be. Secondary radiation is derived from primary by a process of scattering, which also involves a reduction in the penetrating power (hardness) of the rays. Soft γ-rays from radium are turned back to a somewhat greater extent than hard γ-rays, and metals of high atomic weight have more scattering power than those of low atomic weight. The experiments are held to give little or no support to Kleeman's theory of selective absorption (Abstr., 1908, ii, 553). R. J. C.

Passage of Röntgen Rays through Gases and Vapours. J. Arnold Crowther (*Proc. Roy. Soc.*, 1909, *A*, 82, 103—127).—A number of experiments on the absorption of primary Röntgen rays and the degree of ionisation produced in different gases by the passage of the rays are described; part of the results have already been published (this vol., ii, 287). The amount of ionisation produced by the direct action of the rays on a gas is directly proportional to the pressure of the latter. The relative ionisation (compared with air as standard) is an approximately additive property, as shown by experiments with air, hydrogen, methyl and ethyl chlorides and iodides, and this is the more nearly true the harder the rays.

In continuation of earlier experiments on secondary Röntgen radiation (compare Abstr., 1907, ii, 922), it is now shown that the amount of secondary radiation emitted by different gases relatively to air is approximately independent of the hardness of the primary rays. Further, comparison experiments with primary and secondary rays indicate that the absorbing power of a gas for the secondary rays emitted by itself is normal. The total ionisation produced by the complete absorption of Röntgen rays in different gases is not the same, and the relative values depend on the hardness of the rays. The amount of energy required to produce an ion in different gases is somewhat different, and also depends on the hardness of the rays.

G. S.

Diffusion of Actinium and Thorium Emanations. SIDNEY RUSS (*Phil. Mag.*, 1909, [vi], 17, 412—422).—Rutherford's method of measuring the velocity of diffusion of active gases, namely, by comparing the amount of active deposit formed at varying distances from the source of activity, has been applied to the emanations of actinium and thorium. The rates of diffusion of actinium emanation in air, hydrogen, carbon dioxide, sulphur dioxide, and argon are, in accordance with Graham's laws, within the limits of error. The velocities of diffusion of actinium emanation in air at pressures varying from 764 mm. to 14 mm. are also in agreement with the ordinary laws of diffusion. Thorium emanation diffuses in a normal manner in argon and in air at various pressures. Since actinium emanation diffuses 1·19 times as quickly as thorium emanation, the molecular weights of the two emanations are as 1 to 1·42. Radium and thorium emanations have practically the same molecular weight, but actinium emanation has a much smaller molecule. Hence it is urged that actinium is not one of the products in the direct line of descent from uranium to radium.

R. J. C.

Presence of Thorium in Rocks. GIAN A. BLANC (*Atti R. Accad. Lincei.*, 1909, [v], 18, i, 241—246).—From measurements of the quantity of emanation liberated from a definite area of the soil of the garden surrounding the Physical Institute of Rome, the conclusion is drawn that one gram of this soil contains at least $1·45 \times 10^{-5}$ gram of thorium (compare Abstr., 1908, ii, 248).

The author has examined a number of samples of rock in order to ascertain whether they contain amounts of thorium sufficient to account for an appreciable proportion of the radioactivity of the earth's crust, the procedure being as follows. A weighed portion taken from the interior of the specimen was powdered and fused with sodium and potassium carbonates, the part of the fusion insoluble in water being treated with hydrochloric acid, and the solution freed from silica by filtration. After adding sulphuric acid and separating the insoluble sulphates, including that of radium, ammonia was added and the precipitated hydroxides dried, powdered, and tested for radioactivity. These hydroxides exhibit activity which gradually increases for about a week, and which is not due, in appreciable proportion, to radium. The presence of uranium in the hydroxides is excluded, since uranium carbonate is soluble in dilute solutions of the alkali carbonates; further, by adding known quantities of uranium to the hydroxides, it is found that the quantities of this metal necessary to produce the observed effects are considerably greater than would be expected from the values of the ratio uranium : radium calculated theoretically by Rutherford and confirmed experimentally by Boltwood.

The proportions of thorium found in one gram of various rocks are as follows: Syenite, $8\cdot28\times10^{-5}$ and $6\cdot30\times10^{-5}$ gram; granite, $3\cdot14\times10^{-5}$ and $2\cdot07\times10^{-5}$. It will be seen that these amounts are of the same order as the amount found in the soil of Rome (*vide supra*).

T. H. P.

Behaviour of Bound and "Free" Electrons towards Electromagnetic Radiation. JOHANN KOENIGSBERGER and K. KILCHLING (*Ann. Physik,* 1909, [iv], 28, 889—924).—A critical comparison is made of the various electron theories as applied to the phenomena of absorption and dispersion. In reference to these, measurements have been made of the absorption of various organic colouring matters, coloured minerals, and coloured glasses, and of the variation of the absorption with the temperature. The data obtained are used to calculate the number of vibrating particles (p) which are associated with one molecule of the organic colouring matter. The value of p is one, and from the value of $p.e/m$ the authors conclude that this vibrating particle is a negative electron. Since the value of p is practically independent of the temperature, it follows that the total number of vibrating electrons remains unchanged when the temperature is varied. In the last section of the paper, the selective absorption of the elements and its relationship to Abegg's theory of valency is discussed.

H. M. D.

Existence of Positive Electrons in Vacuum Tubes. A. DUFOUR (*Compt. rend.*, 1909, **148**, 481—484).—J. Becquerel (*ibid.*, 1908, **146**, 1308; Abstr., 1908, ii, 751) has described certain experiments which have led him to assume the existence of free positive electrons. The author has repeated and confirmed Becquerel's observations, but shows that the deviation of the beam on which the theory of the latter is based is not due directly to the field, but is only the consequence of the displacement of the patch where the rays strike the glass when a magnetic field acts on the cathode rays. The beam in question is therefore a beam of canal rays, produced under somewhat unusual conditions.

G. S.

Hypothesis of Positive Electrons. JEAN BECQUEREL (*Compt. rend.*, 1909, **148**, 546—548. Compare Abstr., 1908, ii, 751).—A reply to Dufour (compare preceding abstract), in which the author maintains the correctness of the observations which led him to formulate the hypothesis of positive electrons. It is also claimed that the conditions obtaining in the experiments of Dufour were not identical with those in the experiments of the author.

H. M. D.

The Kinetic Energy of the Positive Ions Emitted by Hot Platinum. F. C. Brown (*Phil. Mag.*, 1909, [vi], 17, 355—361).—The kinetic energy of the positive ions emitted by hot platinum has been determined by measuring the rate of charging up of a metal plate by the ions from a hot strip of platinum contained in a parallel plate. Provided the distribution of energy follows Maxwell's laws, the gas constant should be calculable from the relation of current to voltage under these conditions. The temperature of the platinum was not allowed to exceed 1020°, since at higher temperatures negative ions are also evolved. In all cases the gas constant could be satisfactorily calculated, showing that Maxwell's laws hold good. The ions do not arise from chemical action, nor are they electrons, but are more probably evaporated atoms of some foreign substance. New platinum gives an abnormal number of ions when first heated.

R. J. C.

Absolute Zero of Potential. Herbert Freundlich and E. Mäkelt (*Zeitsch. Elektrochem.*, 1909, 15, 161—165).—Billitzer (*Ann. Physik*, 1903, [iv], 11, 923) found that silver powder falling through a solution of silver nitrate produces a current the direction of which changes when the concentration of the silver ions is diminished by adding a halogen salt and ammonia or potassium cyanide. In the solution in which the reversal occurs, the difference of potential between silver and solution is zero, and a measurement of the *E.M.F.* of a combination of a calomel electrode with silver in this solution gives the absolute *E.M.F.* of the calomel electrode. Billitzer found +0·13 volt in this way, the usually accepted value obtained by means of a mercury-dropping electrode being −0·57 volt. The authors have repeated Billitzer's experiment and confirmed it. They find, however, that the sign of the charge on the silver is but little affected by the silver ions. Hydrogen ions give a positive, hydroxyl ions a negative, charge to the silver, but in a solution of barium hydroxide it is positive, owing to the stronger action of the barium ions. The charge varies with the nature of the ions in the solution in exactly the same way as the charges on colloidal particles or on particles of non-metallic substances, and are probably due to friction and have nothing to do with the equilibrium between silver and silver ions, and therefore can give no information about the zero point of the potential series.

T. E.

Potential Energy of the Elements. Daniel J. Rankin (*Chem. News*, 1909, 99, 195. Compare Abstr., 1908, ii, 680).—In view of the fact that the values for the potential energy of the elements are functions of the atomic weights, and a change in the second decimal place of the latter effects, in some instances, two integers in the value of the potentials, it is necessary that the potentials should be subject to revision concomitantly with the atomic weight. The potential energy of the elements have been corrected by the atomic weights for 1909 and are tabulated. Graphically representing the volumes of static energy and potential energy of the elements by concentric circles, the effect of external energy on the sphere of potential is regarded as determining whether or not combination occurs; in this view, the hypothesis of an interatomic fluid (ether) appears unnecessary. J. V. E.

Potential of the Ferro-Ferricyanide Electrode. Gilbert N. Lewis and Ledyard W. Sargent (*J. Amer. Chem. Soc.*, 1909, 31, 355—363).—The potential of a gold electrode dipping in a solution of potassium chloride containing potassium ferrocyanide and ferricyanide has been measured against a calomel electrode in the usual way. The three salts were used in varying concentrations, and the results are reproducible to 0·0001 volt. The temperature-coefficient of the *E.M.F.* was measured at two different concentrations, and from the results it has been calculated by the Helmholtz formula that the heat of the reaction represented by the equation $Hg + Cl' + Fe(CN)_6''' = HgCl + Fe(CN)_6''''$ is 18,500 cal., in moderate agreement with the value determined directly.

The data obtained form the most accurate test so far made of the validity of the rule that in a mixture of salts having a common ion, the degree of dissociation depends solely on the concentration of that ion. The exact influence of the $K^{\cdot}$ ion on the potential cannot be calculated, but increasing the concentration of that ion diminishes the ionisation of the ferrocyanide more than that of the ferricyanide, as theory indicates. In the presence of 0·8*N*-potassium chloride the ionisation of potassium ferrocyanide into the $Fe(CN)_6''''$ ion does not exceed 2—3%, a result which can only be reconciled with electrical conductivity measurements on the assumption that intermediate ions play an important part in the process of conduction. The potentials are independent of the nature of the anion. G. S.

Potentials between Liquids. Gilbert N. Lewis and Ledyard W. Sargent (*J. Amer. Chem. Soc.*, 1909, 31, 363—367).—The potential of a gold electrode in a solution of a potassium salt containing small quantities of potassium ferro- and ferri-cyanide depends only on the concentration of the potassium ion and the ratio of ferro- to ferricyanide (preceding abstract). If two such electrodes in solutions of two different potassium salts of the same $K^{\cdot}$ ion concentration, and containing the same quantities of ferro- and ferri-cyanide, are combined, the electrode potentials balance, and the observed potential is that between the two liquids. The method, which has already been employed by Sauer (Abstr., 1904, ii, 307), has been used to determine the contact differences of potential between dilute solutions of certain alkali salts with univalent anions, and the results are in excellent agreement with those calculated by a slightly modified form of the well-known Planck formula. Even when the alkali ion concentration is not quite the same for the two solutions, a correction can be applied and the method is applicable. G. S.

[Electromotive Force of the Hydrogen-Oxygen Cell.] Correction. J. N. Brönsted (*Zeitsch. physikal. Chem.*, 1909, 65, 744. Compare this vol., ii, 10).—When a slight error in calculating the value for the *E.M.F.* of the hydrogen-oxygen cell is corrected, the value $E = 1{\cdot}234$ volts is obtained, in still better agreement with Nernst's value, 1·232 volts. G. S.

Electromotive Form of Nickel and the Effect of Occluded Hydrogen. Eugene P. Schoch (*Amer. Chem. J.*, 1909, 41, 208—232).—Experiments have been made to determine the true reversible potential difference between nickel and *N*-nickel sulphate solution. This potential difference depends very considerably on the mode of preparation and previous treatment of the nickel electrode; it is diminished by air or oxygen, increased by hydrogen, and lowered by slight acidity of the nickel sulphate solution. The true equilibrium potential, which was reached from both sides, is given as $0{\cdot}48 \pm 0{\cdot}005$ volt. This value is reached in about twelve hours if an electrode of commercial nickel is immersed in the sulphate solution, which is boiled for some minutes and allowed to cool out of contact with the air. The solution should be perfectly neutral to litmus. The effect of occluded hydrogen on the potential difference was examined in detail. For both sheet nickel and finely divided nickel, prepared by reduction of the oxide in a current of hydrogen, the potential difference is increased. In consequence of this it is found that the electrolytic deposition of nickel does not take place until the potential is from 0·2 to 0·3 volt higher than the equilibrium potential, hydrogen being simultaneously deposited.

The equilibrium potential for finely divided nickel in contact with *N*-nickel sulphate solution is about 0·52 volt. A similar increase in the potential of finely divided iron as compared with solid iron was found by Richards and Behr. H. M. D.

Behaviour of the Nickel Anode and the Phenomena of Passivity. Eugene P. Schoch (*Amer. Chem. J.*, 1909, 41, 232—256. Compare preceding abstract).—The dependence of the anode potential of nickel on the current density has been examined for normal solutions of nickel sulphate, nickel chloride, and potassium sulphate. The effect of the addition of the corresponding acids to the nickel salts and of potassium hydroxide to the potassium sulphate was also investigated. The nature of the observed phenomena may be described with reference to the nickel sulphate solution.

For current densities less than 4 milli-amperes per square decimetre, the nickel shows normal anodic behaviour, and the potentials are readily reproducible. This is not the case if higher current densities are used, and with excessive densities the potential falls continuously until the evolution of oxygen sets in. The chemical action which takes place as long as the potential for the evolution of oxygen has not been reached, is a quantitative solution of nickel. There is neither a critical voltage nor a critical current density which marks the termination of the normal anodic behaviour and the transition to the passive condition. The potential and density values corresponding with this transition depend on the previous electrolytic treatment. When the current is discontinued, the potential at the anode begins to rise immediately, the rate of rise diminishing with increase in the extent of the preceding electrolysis and with diminution in the accompanying potential.

The observations lead the author to conclude that nickel has a very small ionisation velocity; in consequence of this, comparatively small current densities result in the liberation of oxygen. Whether the nickel in the passive condition is protected by a layer of oxygen or covered by an oxide film cannot be decided on the basis of the observed facts. H. M. D.

Maximum Voltage of Electrolytic Valve Cells. GÜNTHER SCHULZE (*Ann. Physik*, 1909, [iv], 28, 787—807. Compare Abstr., 1907, ii, 842; 1908, ii, 350, 560, and 658).—Experiments are described in which the author has examined the dependence of the maximum potential of the aluminium valve on the period of formation of the electrode, the nature of the dissolved electrolyte, and the thickness of the gas layer. The observations are in agreement with the view that the valve action is not due to the layer of oxide on the electrode, but to a much thinner layer of gas which is confined within the pores of the solid covering and separates the electrolyte from the metal. The phenomena observed in the process of formation of the valve are readily explained if it is assumed that the anions give rise to electrons when they reach the gas layer. The cause of the maximum voltage is attributed to the fact that the layer of gas cannot increase in thickness in consequence of spark discharge taking place when a certain potential is reached. The spark potential increases with the dilution of the electrolyte, and for different electrolytes at the same concentration it appears to increase as the degree of dissociation decreases; it is independent of the current density used in the formation of the valve electrode and also of temperature. The paper contains a series of plates showing oscillographic records of the current through valve cells under conditions corresponding with continuous flow and spark discharge.

H. M. D.

Oxide Theory of the Oxygen Electrode. II. RICHARD LORENZ and E. LAUBER (*Zeitsch. Elektrochem.*, 1909, 15, 157—161. Compare this vol., ii, 15).—A cell consisting of two lead plates immersed in sulphuric acid is used. Hydrogen is passed through the acid surrounding the cathode plate. The cell is polarised under varied conditions, and the discharge curves then observed in the way previously described (this vol., ii, 15). Arrests were observed in the discharge curve at 2·05, 1·62, 1·43, 1·09, 0·79, 0·63, 0·53, 0·43, 0·12, 0·05, −0·14, −0·24, −0·29, and −0·45 volts. Streintz has measured the *E.M.F.* of combinations of different lead oxides and zinc in sulphuric acid; these are 0·34 volt greater than the *E.M.F.*'s of corresponding cells with a hydrogen-lead cathode. Streintz's measurements give for the combination Pb | PbO_2 | H_2SO_4 | H_2 | Pb, 12·07 volt, and when the lead peroxide is replaced by other compounds, the following results: H_2PbO_3, 0·62 volt; Pb_3O_4, 0·41 volt; PbO, 0·12 volt; Pb_2O, 0·08 volt; massive lead, −0·14 volt; lead sponge, −0·23 volt; $PbSO_4$, −0·28 volt. These results agree well with eight of the fourteen arrests observed, the substances corresponding with the remainder are not identified. T. E.

Actinic Influence on Electrochemical Action. L. Ray Ferguson (*J. Physical Chem.*, 1909, **13**, 262—265).—It was stated by Robert Hunt (this Journ. 1845, **2**, 311) that on exposing the element Pt | KI | $AgNO_3$ | Pt to sunlight, although iodine was liberated at the anode, no silver was precipitated at the cathode, whereas in the dark crystals of silver were produced. The author finds that the *E.M.F.* of this element is 0·3 volt whether in dark or light, and under all conditions silver is liberated on completing the circuit. Hunt's experiments could not be repeated. R. J. C.

Electrical Conductivity of Solutions of Electrolytes in Water, Methyl or Ethyl Alcohol, Acetone, or in Binary Mixtures of these Solvents. S. W. Serkoff [*J. Russ. Phys. Chem. Soc.*, 1908, **40**, 399—427; 1909, **41**, 1—43 (Physical Part)].—The author has measured the conductivities of solutions of various concentrations of lithium chloride, bromide, iodide, and nitrate, ammonium thiocyanate, and sodium iodide and salicylate in the above-mentioned solvents.

The solutions in a mixture of water and methyl alcohol all exhibit a minimum in the conductivity curve, this minimum corresponding closely with the maximum viscosity of the mixed solvent. The conductivities in mixtures of water and ethyl alcohol are for all the electrolytes much smaller than those calculated from the law of mixtures, owing to the greatly increased viscosity of the mixed solvent. With mixtures of methyl and ethyl alcohols, the conductivity curves are approximately rectilinear for all the electrolytes examined.

For mixed solvents of which one constituent is acetone, no parallelism exists between the conductivity and viscosity curves; when the mixture contains 75% of acetone, all the electrolytes exhibit a more or less well-marked maximum of conductivity. Sodium and lithium iodides, dissolved in a mixture of acetone and one of the three other solvents, give conductivity curves very similar to the corresponding fluidity curves; with lithium chloride and nitrate and sodium salicylate, however, the conductivity and fluidity curves are totally dissimilar, whilst with lithium bromide and ammonium thiocyanate, intermediate behaviour is observed. This maximum conductivity is not due to increase of the degree of dissociation, but is explained by the resolution of the compounds of the ions with the solvent. The lower the conductivity of an electrolyte in acetone at infinite dilution, the more marked is its maximum conductivity. In a mixture of 75% acetone with 25% of one of the alcohols, the conductivities at infinite dilution of all the lithium salts are approximately equal. T. H. P.

Action of Electrolytes on Copper Colloidal Solutions. E. F. Burton (*Phil. Mag.*, 1909, [vi], **17**, 583—597. Compare Abstr., 1906, ii, 275, 841).—The influence of electrolytes on the velocity with which the positively charged colloidal particles of copper move in an electric field has been investigated. The colloidal solutions were prepared by Bredig's method, and the electrolytes used were potassium chloride, sulphate, phosphate and ferricyanide, and aluminium sulphate. Corresponding with the positive charge of the colloidal particles, it is found that the negative ion is the active agent in diminishing the velocity. The specific activity of the anion depends on its valency, and the relative activities of anions of different valency are approximately the same as the relative activities of these ions in respect of coagulative power. Observations on the coagulation of the copper solutions indicate that this takes place when the charge on the particles is neutralised, and these are no longer capable of moving in an electric field. H. M. D.

Electrolytic Precipitation of Cuprous Oxide. D. MILLER (*J. Physical Chem.*, 1909, 13, 256—261).—The author has endeavoured to find the conditions for the electrolytic production of cuprous oxide in the finest state of subdivision. Sodium chloride solutions at 60° to 100° were electrolysed between copper poles. The higher the temperature and smaller the current density, the larger the particles and darker the colour of the precipitate. Increased concentration of the salt solution appeared slightly to decrease the size of the particles obtained. A very small proportion of gelatin had a very marked effect in reducing the size of the particles and lightening the colour. It was found that in the lighter (yellow) precipitates the cuprous oxide was largely hydrated. R. J. C.

Formation of Autocomplexes in Solutions of Cupric Bromide, Cupric Chloride, and Cobalt Bromide. HENRY G. DENHAM (*Zeitsch. physikal. Chem.*, 1909, 65, 641—666).—Kohlschütter (Abstr., 1904, ii, 338) has shown that the transport number for the $Cu^{\cdot\cdot}$ ion in aqueous solutions of cupric chloride diminishes with increasing concentration of the solution, and finally becomes strongly negative; this result is accounted for on the assumption that complex anions of the type $CuCl_4''$ and $Cu(H_2O)Cl_3'$ are formed in increasing amount as the concentration of the solution is increased. In the present paper, it is shown that the transport number for the $Cu^{\cdot\cdot}$ ion in aqueous solutions of cupric bromide and cupric chloride and in alcoholic solutions of the former salt diminishes, and finally becomes negative, with increasing concentration, and the increased complex formation goes parallel with the change of colour in aqueous solution from bluish-green to brown. The transport number is more negative in alcoholic than in aqueous solutions of corresponding concentration, indicating greater tendency to complex formation in the former solvent. In the transport measurements the copper is precipitated at the cathode, mainly in the form of cuprous salt, but the amount of the latter is not proportional to the amount of silver liberated in the silver voltameter, and a correction has to be applied for the cuprous salt remaining in solution. The neglect of this precaution probably accounts for the fact that Kohlschütter's results, although in qualitative, are not in quantitative agreement with those described in the present paper.

Further, the transport numbers for the $Co^{\cdot\cdot}$ ion in aqueous and alcoholic solutions of cobalt bromide diminish with increasing concentration of the solutions, and finally become negative.

The results of all these transport measurements are satisfactorily accounted for on the assumption that complex anions of the type CuX_3' and CuX_4'', respectively CoX_3' and CoX_4'' (X = halogen ion), are formed in increasing amount as the concentration increases (compare Donnan and Bassett, Trans., 1902, 81, 939). The question as to how far the accompanying changes of colour are also connected with differences of hydration is left undecided. G. S.

Dissociation Constants of the Dihydroxybenzenes. HANS EULER and IVAN BOLIN (*Zeitsch. physikal. Chem.*, 1909, 66, 71—77).—The acid dissociation constants of catechol, resorcinol, and quinol have been obtained by measuring the electrical conductivity of the ammonium salts in aqueous solution at 18° with the following results: catechol, $K_a = 3{\cdot}3 \times 10^{-10}$; resorcinol, $K_a = 3{\cdot}6 \times 10^{-10}$; quinol, $K_a = 1{\cdot}1 \times 10^{-10}$ at 18°, $0{\cdot}57 \times 10^{-10}$ at 0°. When quinol forms salts in very dilute solution, an intense yellow colour is observed; this is not due to oxidation, but probably indicates that the salt exists in a quinonoid form. Quinone also forms a salt with an equivalent amount of alkali in dilute solution (K_a in this case exceeds 10^{-13}), but the conductivity of the mixture rapidly diminishes; this is connected with a chemical change (in absence of oxygen) in which quinol and a higher acid oxidation product are formed.

It is a general rule that in the carboxylic acids negative substituents increase the strength to a greater extent in the ortho than in the meta or para position (Ostwald), but resorcinol is rather stronger than catechol, and the authors confirm the statement of Hantzsch that *p*-nitrophenol is rather stronger than *o*-nitrophenol, so that the above rule does not hold for the acidic properties of hydroxy-compounds. G. S.

The Electron Theory of the Carbon Arc. JAMES A. POLLOCK (*Phil. Mag.*, 1909, [vi], 17, 361—366).—The author discusses the distribution of potential in a direct current arc on the basis of the theory that negative electrons are projected from hot carbon whether it be positive or negative pole. This projection gives rise to a forward or backward *E.M.F.*, according as it is from the negative or positive carbon. The electrons are arrested by collision with molecules, giving rise to a comparatively immobile layer of negative ions. This layer is the cause of the well known anode fall of potential, which is equal to the back *E.M.F.* at the anode, both depending on the temperature of the crater. The cathode fall of potential attains a characteristic value in all carbon arcs. The theory is shown to be in quantitative agreement with Duddell's results. R. J. C.

Magnetic Properties of Certain Compounds of Iron. S. WOLOGDINE (*Compt. rend.*, 1909, 148, 776—777).—The temperatures have been determined at which various compounds of iron are demagnetised. The powdered substances were immersed in a suitable liquid, which was placed in a magnetic field. The temperatures at which the particles ceased to form chains between the poles were observed. The following values are recorded: magnetic iron oxide, 525°; iron sulphide (pyrrhotine), 300°; iron carbide, 180°; iron phosphide, 445°; franklinite, 61°; iron tungsten carbide ($2Fe_3C,3W_2C$), 80°.

H. M. D.

Dependence of the Ratio of the Specific Heats of Gases on the Temperature. ROBERT FÜRSTENAU (*Ber. deut. physikal. Ges.*, 1909, 11, 137—138).—In reference to the author's measurements of the specific heat ratio (this vol., ii, 17), it is pointed out that two small corrections were omitted, these being necessary because the entire apparatus was not at one and the same temperature, and because of the influence of the diameter of the tube on the velocity of sound. In the case of air and carbon dioxide at 500°, the specific heat ratio is probably about 1·7% greater than the value previously given.

H. M. D.

Specific Heats of Solutions. I. HERMANN SCHLESINGER (*Physikal. Zeitsch.*, 1909, 10, 210—215).—A method is described for measuring the true specific heats of liquids and solutions at definite temperatures. The apparatus consists of a cylindrical glass vessel of 400—600 c.c. capacity, at the centre of which a spiral wire of platinum is supported; the ends of this are connected with thicker wires, which are sealed through the walls of the vessel. On passing a current through the wire a definite quantity of heat is generated in the interior of the liquid contained in the glass vessel, and the rise of temperature is determined by the expansion which takes place. For the purpose of measuring the increase in volume, the vessel is provided with a capillary tube, which is sealed into the upper part of the apparatus and dips into a small mercury cup. The displacement of the mercury in the graduated capillary tube measures the rise of temperature. The heat developed by the current is obtained by measuring the quantity of electricity by means of a gas voltameter, and the potential difference at the ends of the platinum spiral by means of a voltmeter. In carrying out an experiment, the apparatus, which is provided with two carefully ground taps for the purpose of filling, is placed in a bath, the temperature of which must be kept quite constant during the time required by the experiment. This is absolutely essential, for the method depends on the assumption that the rise of temperature is entirely confined to the inner portions of the liquid, and that the outer portions are subjected to no heat exchange.

Measurements of the specific heat of 5, 65, and 85% sulphuric acid at temperatures ranging from 0° to 70°, and of that of pentane at 0° and $-78°$, are recorded. The specific heat of normal sulphuric acid solution falls from 1·000 at 0° to 0·845 at 35°, and then increases to 0·954 at 60°.

H. M. D.

Calculation of Specific Heats of Solutions. ARTHUR BAKOWSKI (*Zeitsch. physikal. Chem.*, 1909, 65, 727—736).—Taking into account the ionisation, as deduced from electrical conductivity measurements, and on the assumption that the specific heats of the different constituents of a solution are independent of their respective concentrations, a formula, one form of which is $c=[C(\lambda-\lambda')+\delta+nMC_w]/(N+nM)$, is obtained as representing the specific heat, c, of salt solutions. In this expression, λ represents the equivalent conductivity, δ the difference between the water value of the specific heat of the solution and that of the water in the solution, n the number of molecules of water present for each molecule of salt, N and M the molecular weights of salt and water respectively, and C is a constant for any one solution. The formula admits of the calculation of the specific heat of a solution of any concentration when the specific heat at one concentration and the constant C (which depends on the conductivity of the solution) are known, and it is shown from Thomsen's data that it gives satisfactory results. Certain deviations are satisfactorily accounted for on the assumption that in some cases association between solvent and solute occurs. When this is taken into account, the same formula holds, the only effect being that the original significance of the constant C is altered. G. S.

Melting-point or Freezing-point Curves of Binary Systems when the Solid Phase is a Mixture of the Two Components and a Compound is Formed. JOHANNES J. VAN LAAR (*Zeitsch. physikal. Chem.*, 1909, 66, 197—237. Compare Abstr., 1908, ii, 808).—A mathematical paper. A general expression is deduced for the thermodynamic potential of the systems in question when a compound is present, and then a somewhat complicated but quite accurate expression for the dissociation constant K is obtained. It is shown that the above expression yields the well-known formula $\delta\log K/\delta T=q/RT^2$, where q is the total heat of dissociation, and a definite expression is given for q in terms of the internal heat of dissociation and other factors. Nernst's method of setting up a purely empirical expression for q is adversely criticised, as is his theoretical treatment of equilibria in several other respects.

The possible forms of curves in the systems in question are discussed in detail. G. S.

New Form of Platinum Resistance Thermometer, and Molecular-weight Determinations in Fused Potassium Nitrate. JOH. GEORG LEONH. STERN (*Zeitsch. physikal. Chem.*, 1909, 65, 667—694).—The construction of a new form of platinum resistance thermometer, and its application to measure small differences of temperature in the neighbourhood of 300°, are described in detail. The chief sources of error are thermo-*E.M.F.*'s, induction phenomena, and the effect on the melting point of variations in the external temperature, but they have been so far overcome that values constant to within 0·04% were obtained for the freezing point of potassium nitrate. The values of the molecular lowering obtained with different salts are as follows: KNO_2, 7·5; KCl, 14; $NaNO_3$, 15; $AgNO_3$, 18·5; $Sr(NO_3)_2$, 20; $Ba(NO_3)_2$, 20; $SrCl_2$, 43; $BaCl_2$, 43; K_2SO_4, 52; Na_2SO_4, 56. As the depression constant, calculated from the heat of fusion of potassium nitrate by van't Hoff's formula, is about 16, the above results indicate that potassium nitrite is bimolecular, potassium chloride unimolecular, the nitrates of sodium, silver, barium, and strontium slightly ionised, whilst sodium chloride is split up into two parts, barium and strontium chlorides into three parts, and the sulphates of sodium and potassium into more than three parts (ions).

G. S.

Condition of Substances in Absolute Sulphuric Acid. Giuseppe Oddo and E. Scandola (*Zeitsch. physikal. Chem.*, 1909, **66**, 138—152. Compare Abstr., 1908, ii, 353).—A reply to Hantzsch (Abstr., 1908, ii, 14, 462; this vol., ii, 18). The authors have previously found that organic bases and certain other substances in sulphuric acid give values for the molecular weight about half the theoretical value, whilst according to Hantzsch the true values are about two-thirds of the theoretical. Hantzsch has expressed the view that the difference is due to the employment by the authors of insufficiently-dried preparations, but this is now shown to be erroneous. Experiments have been made with a large number of carefully dried organic bases, including pyridine, *a*-picoline, aniline, tribromoaniline, and acridine, and in all cases the molecular weights are about 50% of the theoretical value when calculated on the acid sulphates. Similarly, ammonium, sodium and potassium hydrogen sulphates have about half the theoretical molecular weights in this solvent. For water, up to a concentration of 4%, values about 7/12 of the theoretical molecular weight are obtained, rather less than the value found by Hantzsch.

The cause of the difference is not clear, but it is pointed out that if the first observation in each series of Hantzsch's experiments is neglected, and the authors' value for the freezing-point constant used in the calculation, the values then approximate to half the theoretical value. Traces of sulphur trioxide raise the apparent molecular weight.

G. S.

Cryoscopy of Colloids. Jacques Duclaux (*Compt. rend.*, 1909, **148**, 714—716).—The author considers that the proportionality which exists between the osmotic pressure and the lowering of the freezing point of a solution should also be found in the case of colloidal solutions. Measurements of the osmotic pressures and freezing points of solutions of ferric and thorium hydroxides have been made, and the experimental results support this view. H. M. D.

Calculation of the Critical Temperature of an Associated Liquid from Surface-tension Results. J. Livingston R. Morgan (*J. Amer. Chem. Soc.*, 1909, **31**, 309—322).—The molecular surface tension of an associated liquid can be represented over a wide range of temperature by means of the interpolation formula $\gamma(M/d)_t^{\frac{2}{3}} = A + Bt + Ct^2$, where A, B, and C are constants. The formula may also be written in the form $\gamma(M/d)_t^{\frac{2}{3}} = \gamma(M/d)_0^{\frac{2}{3}} - k_0 t - \frac{1}{2} dk/dt.t^2$, where k is the ordinary "constant" of the Eötvös-Ramsay-Shields formula (which for associated liquids varies with the temperature), k_0 is its value at 0°, and the other symbols have the usual significance. The constants are calculated from the data of Ramsay and Shields for a number of associated liquids by the method of least squares, and it is shown that for a wide range of temperature two sets of coefficients are necessary to represent the experimental results at low and at high temperatures respectively. When the agreement is good at high temperatures, the critical temperature of the liquid is found by equating $\gamma(M/d)^{\frac{2}{3}}$ to zero and solving for the corresponding temperature, which is 6° less than the critical temperature. If, however, there is good agreement at low temperatures, the critical temperature can be calculated from the first differential coefficient of the above equation, $k_t = k_0 + t.dk/dt$, by solving it for the critical temperature. As k for associated liquids proves to be a linear function of the temperature, and attains its maximum value at 6° below the critical temperature, it would become zero at 6° above the negative critical temperature if the latter were attainable. Hence, from the last equation, the critical temperature $t_c = \frac{k_0}{dk/dt} + 6$.

The critical temperatures for water, acetic acid, methyl and ethyl alcohols, calculated by the above methods, are in excellent agreement with the observed values. G. S.

Laboratory Separation of Liquids with Slightly Different Boiling Points by a Process of Distillation. D. D. GADASKIN (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 66—80).—The author finds that beads of aluminium and, to a slightly less extent, of lead make a far more efficient fractionating column than those of glass, the liquid experimented with being a mixture of benzene, b. p. 80—82°, and toluene, b. p. 109—112°. In order to avoid washing of the liquid by the vapour, a cone of aluminium wire, 3 mm. in thickness, is placed with its base resting on the bottom of the dephlegmator and its point uppermost; this arrangement greatly increases the effectiveness of the separation. T. H. P.

New Dephlegmators: Fractional Distillation of Substances of High Boiling Points. MICHAEL M. TICHWINSKY (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 81—89).—Details are given of a number of new forms of dephlegmator. T. H. P.

Vapour Pressure of Saturated Solutions. ALEXANDER W. SPERANSKY (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 90—105).—By means of the tensimeter, using α-bromonaphthalene as manometric liquid, the author has determined the differences in vapour pressure between water and saturated solutions of sodium chloride and nitrate, potassium chloride, tartaric acid, and resorcinol at temperatures 23° to 51°.

The relation between the vapour pressure p of the saturated solution and the temperature T is expressed by Bertrand's formula: $p = K[(T - \lambda)/T]^{50}$, where K and λ are constants. Such a formula is also applicable to saturated solutions of magnesium chloride at 0—25°.

The relation between the vapour pressures of saturated solutions and the percentage concentration, C, is given by the formula: $\log p = a\log C + b$, where a and b are constants. This formula is applicable with moderate accuracy to solutions of sodium chloride and nitrate, potassium chloride, tartaric acid, and magnesium chloride. For resorcinol the deviations are greater, but this may be due to inaccuracy in the determinations of the vapour pressure and solubility, the latter only varying very slightly. This relation $\log p = a \log C + b$ may be expressed in the form $p_1/p_2 = C_1^a/C_2^a$, that is, the vapour pressures of the saturated aqueous solutions of one and the same substance at two temperatures are related to one another as the corresponding concentrations raised to the power a.

The two expressions $p = K[(T-\lambda)/T]^{50}$ and $\log p = a \log C + b$ are applicable to saturated solutions of potassium sulphate at temperatures from the boiling to the cryohydric point.

Combination of these two formulæ gives $C = A[(T-\lambda)/T]^n$, which expresses Bertrand's formula in its general form. T. H. P.

New Method of Measuring the Partial Vapour Pressures of Binary Mixtures. MARTIN A. ROSANOFF, A. B. LAMB, and F. E. BREITHUT (*J. Amer. Chem. Soc.*, 1909, **31**, 448—456 *).—The method described is based on the fact that if a mixed vapour of constant composition is passed through a liquid mixture of the same substances, the composition and temperature of the liquid will steadily change until complete equilibrium, as regards both temperature and pressure, has been established. A stationary temperature indicates that equilibrium has been attained, and the vapour bubbling through the liquid may then be condensed in any quantity and analysed. The liquid can be also withdrawn and analysed. Assuming that the ratio of the partial pressures in the vapour is equal to the molar ratio of the components, and knowing the total pressure from direct observation, the partial pressures can be readily calculated. In cases in which the above assumption is inadmissible, the exact relation between molar ratios and partial pressures can be determined by separate experiments.

The older methods are criticised, and the new method is described in detail. The apparatus consists essentially of an inner tube, in which the saturated mixed vapour of constant composition is passed through the liquid mixture, and an outer vessel surrounding it, in which the vapour is produced by boiling a liquid mixture, the composition of which is kept constant by the introduction of the more volatile component in such quantities as to keep the boiling liquid at a constant temperature. The results of some experiments are quoted which prove that the method is trustworthy. E. G.

Electric Thermoregulator. REGAUD and FOUILLAND (*Ann. Chim. anal.*, 1909, **14**, 141—146).—The apparatus consists essentially of a mercurial siphon barometer, the short limb of which is sealed into a larger tube containing dry hydrogen.

The lower part of the mercurial column is traversed by a portion of the heating current, the conducting wires being so placed that the expansion of the hydrogen will cause the contact to be broken if the temperature of the bath exceeds that desired. This temperature can be altered if needful by inclining the barometer from the vertical.

L. DE K.

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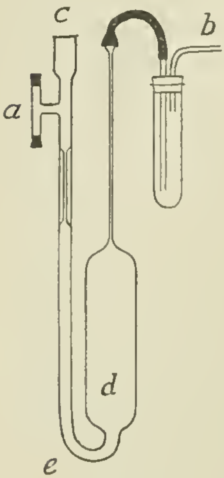
* and *Zeitsch. physikal. Chem.*, 1909, **66**, 349—358.

Simple Method for Filling Toluene Thermoregulators. J. P. McGowan (*Chem. News*, 1909, 99, 181).—The author has devised the following method for filling toluene thermoregulators, considered to be especially advantageous where a salt solution is used between the toluene and mercury. If the side tube *a* is closed, suction at *b* and the introduction of toluene in *c* will cause the filling of the regulator with toluene. The salt solution is then poured into *c* until sufficient has been introduced into the bulb *d*. Finally, mercury is introduced into *c*, and is likewise sucked into the bend *e*; the capillary tube is fused in a blowpipe flame, and the tube *c* is filled with mercury in the usual manner. J. V. E.



The Metalloids Arsenic and Antimony. Thermochemical Point of View. John C. Thomlinson (*Chem. News*, 1909, 99, 133. Compare Abstr., 1908, ii, 1016).—It is found that the heats of formation of NH_3, PH_3, AsH_3, and SbH_3 continually decrease as the atomic weight of the elements N, P, As, and Sb increase, and, consequently, are not in accord with the expected values. This apparent discrepancy is considered to be due to the fact that these compounds are gases, whilst the elements above referred to are solid at the temperature for which the data are reckoned. Hence allowance must be made for the latent heats of fusion and volatilisation of these elements, and, in general, for the difference of heat content between the solid and gaseous state at that temperature. When this is done, the amounts of heat absorbed by phosphorus, arsenic, and antimony in assuming the gaseous state in their hydrides are found to be roughly proportional to their atomic weights. Calculations are made showing an approximate agreement between the calculated and experimentally observed heats of formation of phosphorous acid, arsenic trioxide, and arsenic pentoxide. J. V. E.

Heat of Oxidation of Tin. Heat of Combination of Acidic Oxides with Sodium Oxides. William G. Mixter (*Amer. J. Sci.*, 1909, [iv], 27, 229—234. Compare Abstr., 1908, ii, 929).—The heat of oxidation of tin has been determined by burning the metal in oxygen in a calorimetric bomb, and also by oxidising it by means of sodium peroxide; the methods of procedure were analogous to those described in a previous paper (*loc. cit.*). In the experiments, tin-foil, tin-turnings, and a specimen of tin prepared by decomposing an alloy of tin and sodium by means of alcohol and water were used. The mean results are represented by the equation $Sn + O_2 = SnO_2$ (cryst.) + 137,200 cal. and $Sn + 2Na_2O_2 = Na_2SnO_3 + Na_2O + 133,800$ cal. When tin prepared from the alloy was burned in oxygen, a heat development higher than the average was obtained, although combustion was not quite complete; it is considered probable that the mono- and di-oxides combine with formation of a little sesquioxide, Sn_2O_3, heat being developed in the latter change.

The heat of combustion of stannous oxide was determined with material prepared by two methods: $SnO(cryst.) + \frac{1}{2}O_2 = SnO_2 (cryst.) +$ 71,000 cal. Finally, the heat of combination of amorphous stannic oxide, prepared by heating metastannic acid and sodium oxide, has been determined: $Na_2O + SnO_2$ (amorphous) $= Na_2SnO_3 + 37{,}100$ cal. The thermal relationship between crystalline and amorphous stannic oxide is represented by the equation SnO_2 (amorphous) $= SnO_2$ (cryst.) + 1700 cal. G. S.

General Formula for Saturated Vapours. O. Pilling (*Physikal. Zeitsch.*, 1909, 10, 162—168).—On the assumption that there is a gradual change in density in passing through the surface which separates a liquid from its saturated vapour, and that the behaviour of the substance in the transition layer is regulated by van der Waals' equation, the author deduces the relationship $\log P/p = 2r/3ART$, in which P is the molecular pressure ($= a/v^2$), p the vapour pressure of the liquid at temperature T, r the latent heat of vaporisation, and A and R are constants. P is shown to be equal to $S(1/v + 1/V)/2A$, S being the internal heat of vaporisation, v and V the specific volumes of the saturated vapour and of the liquid respectively. It is further shown that the vapour pressure p (in atmospheres) at the temperature T is given by the equation $T_s/T = (1 - m \log p)^{\frac{2}{3}}$, T_s being the boiling temperature at atmospheric pressure, and $m = 3T_s/\log e\, r_s M$, in which r_s is the latent heat of vaporisation at the temperature T_s, and M is the molecular weight of the substance. A further relationship is given by the equation $r/r_s = (T_s/T)^{\frac{1}{2}}$. The experimental data for water, mercury, ethyl ether, ethyl alcohol, acetone, chloroform, carbon tetrachloride, and carbon disulphide are shown to be in agreement with these two equations. H. M. D.

Modifications in Victor Meyer's Vapour Density Apparatus. Eugenio Morales Chofré (*Anal. Fis. Quim.*, 1909, 7, 10—12).—Slight alterations are suggested in the ordinary apparatus to facilitate the automatic introduction of the substance to be vaporised, and the direct measurement at a constant temperature of the displaced air.

W. A. D.

Molecular Volumes, Densities, and Atomic Weights. Anatole Leduc (*Compt. rend.*, 1909, 148, 548—550).—The values of the relative molecular volume ϕ, as given by the equation $Mpv = RT\phi$, are recorded for twenty different gases. The densities calculated from the molecular weights by the equation $D_0 = 31{\cdot}225\, M/\phi$ are compared with the experimental values of the density. Molecular-weight values, calculated from this equation by inserting the experimental density values, are also recorded. The atomic-weight values of nitrogen deduced from the densities of nitrogen, nitric oxide, nitrous oxide, and ammonia are respectively 14·006, 14·004, 14·0045, and 14·0042. The values for carbon deduced from the densities of carbon monoxide, carbon dioxide, methane, and acetylene are respectively 12·004, 12,003, 12·0056, and 12·005. The value for chlorine, 35·463, is identical with that obtained by Dixon and Edgar, and that for sulphur, 32·072, agrees with that obtained from chemical data. The author draws the conclusion that the method of molecular volumes yields very accurate values for the atomic weights, and that the method is trustworthy both in the case of gases liquefied with difficulty and those which are readily condensed. H. M. D.

Calculation of Molecular Weights by means of Vapour Densities: Toluene. Anatole Leduc (*Compt. rend.*, 1909, **148**, 832—834).—The inaccurate value obtained by Ramsay and Steele (Abstr., 1903, ii, 635) for the molecular weight of toluene is a result of the method followed by these authors to arrive at the limiting value of pv/T, when $p = 0$.

From Ramsay and Steele's numbers, the author finds that the mean coefficient of deviation of toluene vapour from Boyle's law between 60 and 27 cm. pressure agrees closely with the calculated value, so that this vapour exhibits normal behaviour. Calculation of the molecular weight, according to the equation given previously by the author (preceding abstract), leads to numbers varying from 92·074 to 92·094, the mean being 92·083, which is in very close agreement with the real molecular weight, 92·088. This result is so satisfactory that the vapour density of toluene may be employed to calculate the atomic weight of carbon, for which the value 12·003 is obtained.

T. H. P.

Viscosity and Fluidity. Eugene C. Bingham and Miss J. Peachy Harrison (*Zeitsch. physikal. Chem.*, 1909, **66**, 1—32. Compare Abstr., 1906, ii, 218; 1908, ii, 1017).—The fluidities of a large number of liquids, obtained from the viscosity data of Thorpe and Rodger (Abstr., 1897, ii, 374), are plotted against the corresponding temperatures. For a number of non-associated liquids (hydrocarbons, ethers, halogen derivatives) the curves are nearly straight lines, showing that the fluidity is approximately a linear function of the temperature, and the same rule holds approximately for certain associated liquids (organic acids) and also for alcohols at high, but not at low, temperatures. The fluidity of mercury is also approximately a linear function of the temperature. The fluidities of non-associated compounds at their boiling points lie on a straight line, an indication that for those compounds the fluidities are additive properties.

In dealing with different liquids, it is found most satisfactory to compare the slopes of the curves, or the temperatures corresponding with a definite fluidity. On this basis, constants for different atoms (carbon, hydrogen, oxygen, the halogens, etc.) and also for the double linking and the benzene ring are calculated; the constants calculated from different classes of compounds are in good agreement. It is shown that for non-associated liquids the absolute temperatures at which the respective liquids have the fluidity in question can be calculated from the constants with an accuracy of 1%.

The temperatures at which associated liquids have a given fluidity are much higher than those calculated from the constants applicable to associated liquids. On the assumption that viscosities are additive, the degrees of association for a number of associated liquids are obtained by dividing the observed by the calculated temperatures; the results are in general agreement with those obtained by other methods.

For convenience of reference, the fluidities at intervals of 10° for a large number of liquids are given in tabular form. G. S.

Theory of Anisotropic Liquids. II. Emil Bose (*Physikal. Zeitsch.*, 1909, 10, 230—244. Compare this vol., ii, 215).—A detailed account is given of the author's theory that anisotropic liquids consist of molecules which have the form of ellipsoids of rotation and tend to move by preference in the direction of the long axes of the molecules. A division of anisotropic liquids into two classes is suggested, according to whether the transition from the isotropic to the anisotropic form is accompanied by a decrease or an increase in the viscosity. In general, liquids belonging to the second class have a greater molecular weight than those which belong to the first. For liquids belonging to the first group it is shown that the ratio of the maximum viscosity of the isotropic form to the minimum viscosity of the anisotropic form can be accounted for in nearly all investigated cases by the assumption of molecules having the form of ellipsoids of rotation. To account for the existence of two anisotropic forms, the conception of the ellipsoid of rotation is replaced by that of a triaxial ellipsoid. The transition temperatures which limit the stable existence of the anisotropic forms and of the isotropic variety are determined by the relationships which exist between the energy corresponding with the irregular molecular motions and that of the special orientated motions in the direction of the axes of the ellipsoids. The heats of fusion, of transition, and of clearing are discussed, and it is shown that the optical properties of an isotropic liquid are considerably influenced by a magnetic field. H. M. D.

Experimental Investigation of Gibbs's Theory of Surface Concentration regarded as the Basis of Adsorption. II. Wm. C. McC. Lewis (*Phil. Mag.*, 1909, [vi], 17, 466—494. Compare Abstr., 1908, ii, 357).—Further measurements have been made of the surface condensation at the boundary between aqueous solutions and a hydrocarbon oil. The interfacial tension was measured for aqueous solutions of about twenty electrolytes, and in all cases the effect of the electrolyte was to lower the tension. It was found previously that the adsorption effect in the case of aqueous solutions of sodium glycocholate, Congo-red, and methyl-orange is very much greater than that indicated by Gibbs's theory. A similar discrepancy is now found in the case of sodium oleate and sodium hydroxide. On the other hand, the results obtained for aqueous solutions of caffeine are in agreement with Gibbs's equation, and in the case of potassium chloride, silver nitrate, barium chloride, and cupric chloride the adsorbed quantities are of the same order as those indicated by theory, although the experimental values are in every case greater than the calculated values.

Evidence has been obtained that the adsorption of electrolytes is to some extent selective, the cation being more readily adsorbed than the anion; this is probably due to an electrical effect, for the hydrocarbon oil is negatively charged with reference to the aqueous solution, the difference of potential between the oil and water being approximately 0·15 volt. This electrical effect may account for the discrepancies between experiment and theory in the case of the inorganic salts examined, but it is not sufficient to account for the much larger difference found in the case of sodium glycocholate and the other substances in the same group. It is suggested that the greater discrepancies may be due to the change in density of water on passing from the bulk to the surface film, or that an irreversible phenomenon of the nature of gelatinisation upon the oil surface plays a part in the process of surface condensation. H. M. D.

Adsorption of Sugar. Peter Rona and Leonor Michaelis (*Biochem. Zeitsch.*, 1909, 16, 489—498).—The composition of a dextrose solution shaken with animal charcoal is the same after three minutes' treatment as after twenty-four hours, indicating that the retention of sugar is due to true absorption and not to decomposition. Increasing quantities of acetone or acetic acid reduce the adsorption, and in presence of 10% of either it is possible to clarify sugar solutions with charcoal without loss. The presence of protein does not influence the adsorption of dextrose. The above statements apply equally to sucrose.

Normally, a substance is only adsorbed in aqueous solution when it reduces the surface tension of the water. Traube has shown the surface tension of sucrose solutions to be greater than that of water, and similar measurements are now given for dextrose. It is pointed out that a substance may also be absorbed when it increases the compressibility of the solvent, or when under increased pressure it becomes more soluble. E. F. A.

Dissociation of Carbon Dioxide in the Carbon Monoxide-Oxygen Flame. Fritz Haber and Robert Le Rossignol (*Zeitsch. physikal. Chem.*, 1909, 66, 181—196).—Le Chatelier (1888), on the basis of experiments by Deville, which appeared to indicate that carbon dioxide in the flame of carbon monoxide burning in oxygen was dissociated to the extent of 40% at 3000°, calculated the dissociation of carbon dioxide at different temperatures by a thermo-dynamical method, and obtained values in good agreement with the recent observations of Nernst and Wartenberg. The authors point out, however, that the calculation is unsatisfactory in more than one respect, and have been led to repeat Deville's experiments by a modified method. A silver capillary tube, surrounded by a condenser of the same metal, through which cold water circulated, was placed in the flame so that the end of the capillary was 1—2 mm. over the inner cone of the flame, and gases were withdrawn from the latter and analysed. The results indicate that the equilibrium constant

$$K = [CO_2]/[CO] \times [O_2]^{\frac{1}{2}}$$

(where the brackets denote partial pressures) is about 4, corresponding with a dissociation of about 37%. The temperature of the flame is calculated from thermal and other data as lying between 2600° and 2670°, but radiation and other causes render the value somewhat uncertain. This estimate is confirmed by the observation that a very thin piece of iridium foil begins to melt when held just over the inner cone.

Nitric oxide cannot be detected in the flame just above the inner cone, but can just be detected at a point 15 mm. higher. The proportion of nitrogen in the first position is 1·7%, in the second position 4·3%. The proportion of oxygen in both the positions mentioned is about 13%. The original oxygen from the bomb contained 4·5% of nitrogen. G. S.

Molecular Diffusion of Gases through Pores and [the Phenomenon of] Effusion. MARTIN KNUDSEN (*Ann. Physik*, 1909, [iv], 28, 999—1016. Compare this vol., ii, 216).—Measurements have been made of the rate of passage of hydrogen, oxygen, and carbon dioxide through small holes in a platinum plate 0·0025 mm. thick.' Two apertures measuring respectively 5·2 and 66×10^{-6} square cm. were employed, and the dependence of the rate of diffusion on the pressure of the gas was examined.

The experimental results show that the rate of passage of the gas through a small aperture is inversely proportional to the square root of the density and directly proportional to the pressure difference on the two sides, provided that the diameter of the aperture is small in comparison with the mean free path of the molecules. When the ratio of these becomes smaller than 1 : 10, the process no longer takes place according to the requirements of the molecular diffusion formula. For a given pressure difference on the two sides of the aperture the deviations from this formula increase as the ratio of this pressure difference to the mean pressure diminishes. When the diameter of the aperture is more than about ten times as large as the mean free path of the gas molecules, the rate of flow of the gas through the aperture agrees satisfactorily with the law of isothermal effusion.

H. M. D.

Diffusion of Chromium, Iron, and Aluminium Salts through Gelatin Jelly. HENRY R. PROCTER and DOUGLAS J. LAW (*J. Soc. Chem. Ind.*, 1909, 28, 297—299).—Results of experiments are given in which the rate of diffusion of metallic salt solutions was observed; the solutions were poured on the surface of 5% gelatin jelly contained in Nessler cylinders, and coloured pink by the addition of slightly alkaline phenolphthalein. Owing to the hydrolysis of the chromium salts employed, the penetration of the acid was much more rapid than that of the base. Solutions of normal salts and others rendered basic by the addition of definite quantities of sodium carbonate were employed, and it was noticed that in the case of chromium chloride the rate of diffusion and the apparent amount of hydrolysed acid was unaffected by these conditions, whilst with chrome alum, the diffusion of the chromium was rendered much slower, but without any corresponding influence on that of the acid. The rate of diffusion was found to be quite independent of the bore of the tube. Striæ or layers of green were noticed, recalling the effects observed in the diffusion of potassium dichromate in gelatin containing traces of silver nitrate (compare Abstr., 1907, ii, 533). The phenomena in the case of iron and aluminium salts were very similar in character to those observed in the case of chromium salts. W. P. S.

Osmotic Pressure of Sucrose Solutions at 20°. Harmon N. Morse and William W. Holland (*Amer. Chem. J.*, 1909, 41, 257—276. Compare this vol., ii, 216).—Twenty-seven measurements of osmotic pressure are recorded for the usual ten weight-normal solutions. The supply of sucrose, with which the measurements at 10°, 15°, and 25° were made, became exhausted before the series at 20° was completed, and the authors have experienced great difficulty in obtaining fresh material of the same degree of purity. The new material has given slightly higher values than had been expected according to the previous measurements. The data for the various temperatures are compared, and the authors state that the experimental evidence, which has now been accumulated, points to the substantial equivalence of the temperature-coefficients of osmotic and gas pressures. H. M. D.

Selective Permeability of the Coverings of the Seeds of Hordeum vulgare. Adrian J. Brown (*Proc. Roy. Soc.*, 1909, 81, *B*, 82—93).—The permeability of the coverings of the seeds of a variety of barley, *Hordeum vulgare*, var. *cœrulescens*, for dissolved salts and other substances, and the proportions of water taken up from different solutions, have been investigated. The property does not depend on the living protoplasm, as seeds killed by immersion in hot water are equally efficient. The membrane in question is confined to the testa of the seed.

The seeds contain a blue pigment turned red by acids, hence the entrance of the latter can readily be detected. When seeds are immersed in normal solutions of hydrochloric or sulphuric acid, water readily enters, but acid does not. On the other hand, acetic, formic, propionic, and trichloroacetic acids readily enter along with the water, as does ammonia in dilute solution. The seed-covering is impervious for most dissolved salts, but mercuric chloride and cyanide and cadmium iodide pass through, whilst mercuric nitrate and sulphate and cadmium nitrate and sulphate do not diffuse. In aqueous solution, sucrose, glucose, and glycerol do not pass through, but certain non-electrolytes of low molecular weight, such as ethyl alcohol, aldehyde, ethyl acetate, and acetone, readily pass through, as does iodine dissolved in an aqueous solution of potassium iodide. In the experiments in which the covering is permeable, it is shown that this is not due to destruction of the membrane; when, for example, seeds are immersed in a solution containing both acetic and sulphuric acids, only the former acid and water pass through.

The proportion of water absorbed from solution (expressed as a percentage calculated on the original weight of the dry seed), as well as the rate of absorption, depend largely on the nature of the solute.

After eleven days, the seeds have absorbed from a normal solution of sodium chloride 36—37% of water, as compared with 70% from water alone. About the same proportion is absorbed from other alkali chlorides and nitrates, but potassium nitrate gives a distinctly higher value. It is remarkable that the proportion absorbed from normal solutions of sucrose and dextrose is only a little greater than from normal sodium chloride. The amount of water taken up from solutions of substances which pass through the membrane is usually almost as great as from water alone. As regards the rate of absorption, the solution of ethyl alcohol enters at about the same rate as pure water, the solution of acetic acid more rapidly, and the solution of ethyl acetate still more rapidly, although the equilibrium point is the same in each case.

No satisfactory explanation of the semipermeable action in question has been obtained; it may be that the molecules of the two classes of substance are combined in a different way with the solvent. The only strong electrolyte which can traverse the membrane is trichloroacetic acid. G. S.

Origin of Osmotic Effects. II. Differential Septa. HENRY E. ARMSTRONG (*Proc. Roy. Soc.*, 1909, 81, *B*, 94—96. Compare Abstr., 1907, ii, 13, 848, 849, 850; 1908, ii, 814—817; and Brown, preceding abstract).—An attempt to account for the results described in the previous abstract on the basis of the author's theories of solution and osmotic pressure. The measurements involve the study of a struggle for "hydrone" between a mass of fine particles of starch within the grain and the solution outside the grain. The concentrating efficiencies of the solutes are in general agreement with those obtained in other ways. The compounds which penetrate the membrane are presumably slightly, if at all, hydrated, whilst those which do not penetrate form stable hydrates. It is suggested that the colloidal surfaces of the intramolecular passages in the membrane are associated with water molecules ("hydrolated" and "hydronated"); solutes which are hydrolated would be retained in virtue of the attraction between them and the hydrolated membrane, whilst non-hydrolated solutes would pass through. Some isolated observations made by Brown, such as the action of ethyl acetate in promoting the entry of water into the grains, can also be readily accounted for on the author's theory. G. S.

Molecular Weight and Form of Substances. Work of Molecular Weight. MICHEL YÉGOUNOFF (*Centr. Bakt. Par.*, 1909, ii, 23, 1—10).—The form of a substance produced when two substances inter-diffuse depends on the respective molecular weights; similarly, the form of a microbe colony growing in the field of a diffusing substance depends on the molecular weight of the substance. Equations are deduced by means of which the molecular weight may be calculated in certain simple cases from the form of a substance produced under the influence of diffusion, and conversely, when the molecular weight is known, the form of the resulting substance can to some extent be foretold. The work of the molecular weight is,

however, usually masked by many other influences, such as movements of the medium, variation of temperature, and variation of concentration.
G. S.

Aqueous Solutions. Cam. Gillet (*Bull. Soc. chim. Belg.*, 1909, 23, 119—129).—Various properties of aqueous solutions are considered from the standpoint of the view that liquid water consists of molecules of dihydrol and hydrol in dissociation equilibrium corresponding with the equation $(H_2O)_2 \rightleftharpoons \overset{+}{H_2O} + \overset{-}{H_2O}$. Corresponding with the + and − signs, the hydrol molecule is supposed to exist in two forms which are related to one another in a similar way to that exhibited by tautomeric forms. Aqueous solutions of all substances are supposed to contain chemical compounds formed by union of the dissolved substance with the positive or negative hydrol. Corresponding with the increase in the dissociation of the dihydrol molecules with rise of temperature, the solubility of most substances in water increases. The changes in volume in the formation of a solution, the lowering of the vapour-pressure, and the osmotic pressure are discussed in relation to the dissociation equilibrium and the formation of compounds of hydrol with solute.
H. M. D.

Mutual Influence on Solubility in Aqueous Solutions of Ether, Chloroform, Phenol, etc. Hermann Fühner (*Ber.*, 1909, 42, 887—889).—The fact that a clear saturated aqueous solution of chloroform when mixed with a similar solution of ethyl ether produced a turbidity due to the separation of a mixture of ether and chloroform led to the examination of the behaviour of a number of aqueous solutions of organic solvents. The solubility of ether in water at 20° is 6·48%, and that of phenol, 8·40%, yet 5% solutions when mixed become milky, although 4% solutions remain clear after mixing. These phenomena have also been examined by Traube's stalagmometer.
W. R.

Theory of Concentrated Solutions. J. Timmermans (*Bull. Soc. chim. Belg.*, 1909, 23, 129—148).—The author is of the opinion that the anomalies exhibited by concentrated as compared with dilute solutions are to be explained by the application of the ideas of van der Waals and not by the assumption that compounds are formed. The influence of pressure on the mutual solubility of a pair of liquids is considered, and it is shown that, in general, a pair of liquids can be made to pass through all the stages of mutual miscibility by varying sufficiently the external pressure. It is thus possible to pass continuously from dilute to concentrated solutions by variation of the pressure, and, on the basis of this, the author proposes to elaborate a theory of concentrated solutions.
H. M. D.

Supposed Influence of Crystallisation in Modifying the Properties of the Solution of a Substance Prepared by Mixing two Solutions. Désiré Gernez (*Compt. rend.*, 1909, 148, 537—541).—The author has repeated some experiments which were performed sixty years ago and appeared to show that the rotatory power of a solution prepared by mixing equal volumes of equimolar solutions of sodium and potassium tartrates is different from that of an equally concentrated solution prepared from the crystalline double salt. Equimolar solutions of the two tartrates were mixed in equal volumes and the rotation observed; the solution was then allowed to crystallise completely, and a fresh solution of the same concentration was prepared from the separated crystals. The rotation of this solution was exactly the same as that of the original solution. The same result was obtained with sodium and ammonium tartrates. H. M. D.

Existence and Properties of Dispersive Systems in the Region between Colloidal and Crystalloidal Solutions. The Svedberg (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 168—175).—By the reduction of auric chloride solutions by means of hydrazine and an ethereal solution of phosphorus, employing solutions of gradually decreasing concentration, the author prepared colloidal solutions of metallic gold containing particles of gradually diminishing size. By the hydrolysis of ferric chloride solutions and by the action of hydrogen sulphide on solutions of arsenious acid, a similar series of colloidal solutions of ferric hydroxide and arsenious sulphide was obtained. The absorption of light by these solutions was examined, and it was found that the specific absorption (the absorption due to each particle of the suspended phase) diminishes as the size of the particles decreases, and approximates to the absorption which is characteristic of the crystalloidal solution. H. M. D.

Crystal-like Arrangement of Fine Solid Particles. Rudolf Krulla (*Zeitsch. physikal. Chem.*, 1909, 66, 126—128).—Iron and tin were fused together in a graphite crucible under a layer of sodium hydrogen carbonate, the greater part of the sodium carbonate removed by washing, and the fused mass placed in a dish with water and stirred. After some time it was noticed that part of the metallic-looking dust on the surface of the water had arranged itself in the form of a star, and on stirring, new star-like groups were formed. The composition of the stars could not be determined, neither was it found possible to repeat the experiment. A number of the groups are figured. G. S.

Inorganic Ferments. IV. Iridium Catalysis of Hydrogen Peroxide. G. A. Brossa (*Zeitsch. physikal Chem.*, 1909, 66, 162—180. Compare Bredig and co-workers, Abstr., 1900, ii, 213; 1901, ii, 441, 442).—Fairly stable solutions of colloidal iridium have been prepared by Bredig's method, using a current of 20—25 amperes at 220 volts. The solutions are reddish-brown or black, depending on the conditions of preparation; a relatively small current favours the production of black solutions. The solution decomposes hydrogen peroxide rapidly; the reaction is unimolecular, and the rate is approximately proportional to the concentration of the catalyst. Unlike its effect on the catalytic action of other colloidal metals, alkali does not affect the rate of decomposition of hydrogen peroxide by iridium. Acids accelerate the reaction in dilute solution, but some of them retard it in concentrated solution. The magnitude of the effect varies greatly with the nature of the iridium preparation, in some cases it is scarcely noticeable. The rate of the reaction is retarded by hydrogen sulphide, mercuric chloride, potassium cyanide, and certain other compounds, but not by iodine. The temperature-quotient for a change in temperature of 10° is 1·6. G. S.

Application of Nernst's Theorem to Certain Heterogeneous Equilibria. John Johnston (*Zeitsch. physikal. Chem.*, 1909, **65**, 737—743).—The substance of a paper previously published (compare Abstr., 1908, ii, 812) is repeated in reply to Schottky's criticisms (Abstr., 1908, ii, 1016) of the author's work (Abstr., 1908, ii, 358).
G. S.

Equilibria between the Liquid and Solid Phases in the System $NaCl + H_2O$. Camille Matignon (*Compt. rend.*, 1909, **148**, 550—553).—The eutectic temperature was found to be $-21·3°$, and the solution in equilibrium with the two solid phases contains 30·7 parts of sodium chloride per 100 parts of water. The freezing points of solutions containing 11, 15, 20, and 25 parts of sodium chloride per 100 of water are respectively $-6·6°$, $-9·25°$, $-12·7°$, and $-16·66°$. The solubility of the hydrate $NaCl,2H_2O$ at $-12·25°$ corresponds with 32·9 parts of sodium chloride per 100 of water.
H. M. D.

Dependence of the Reaction Velocity on the Temperature in Homogeneous Gaseous Systems. Hans Goldschmidt (*Physikal. Zeitsch.*, 1909, **10**, 206—210).—A theoretical paper, in which the author has deduced a relationship between the rate of change in a gaseous system and the temperature. It is assumed that the molecules which undergo change are solely those which have velocities greater than a certain limiting value, and by applying Maxwell's distribution law, an equation is obtained which gives the connexion between the values of the velocity constants for two different temperatures. The equation involves three terms in which the two temperatures are involved, but two of these can be neglected in comparison with the third at temperatures not very different from the normal. The resulting equation is then identical with the empirical equation set up by Arrhenius to express the results of experimental measurements.
H. M. D.

Equilibria in the System $(CH_3CO)_2O-B_2O_3-H_2O$ at 30°. M. Dukelski (*Zeitsch. anorg. Chem.*, 1909, **62**, 118—122).—The solubility of boric acid in water is diminished by the addition of acetic acid, and in glacial acetic acid the solubility is very small. Addition of acetic anhydride now increases the solubility very greatly, new solid phases being formed. For the estimation of acetic acid in presence of boric acid, the best results are obtained by titration with iodide-iodate solution, towards which boric acid is indifferent, and thiosulphate. The reaction is a very slow one, and it is necessary to keep the solutions forty to forty-four hours in stoppered vessels at 15—18° before titrating with thiosulphate (compare Gröger, *Zeitsch. angew. Chem.*, 1899, **12**, 356, and Kux, Abstr., 1893, ii, 307).

The products obtained from solutions containing acetic anhydride may also be prepared by decomposing the compound $B_2O_3,3Ac_2O$ (Pictet and Geleznoff, Abstr., 1903, i, 601). The regions of stability have been partly determined at 30° for the solid phases $B(OH)_3$, $B_2O_3,2Ac_2O$, and $B_2O_3,3Ac_2O$. C. H. D.

Saponification in Stages of the Esters of Dibasic Acids. I. Julius Meyer (*Zeitsch. physikal. Chem.*, 1909, **66**, 81—125. Compare Abstr., 1907, i, 462, 819).—The formulæ representing the saponification in stages of the esters of dibasic acids on different assumptions as to the relative values of the two velocity constants are deduced. In continuation of earlier work on the hydrolysis of the esters of glycol and glycerol in acid solution, the rate of hydrolysis of a number of acid and normal esters of tartaric, succinic, and camphoric acids in dilute (0·01—0·1*N*) hydrochloric acid have been determined at 18° and 25°, and also at higher temperatures for the esters of the last-mentioned acid.

In the case of all the esters of tartaric and succinic acid, the reaction is apparently unimolecular. The hydrolysis of the esters of the first two acids really proceeds in the two stages: (1) diester $\longrightarrow$ monoester + alcohol; (2) monoester $\longrightarrow$ acid + alcohol, but as the velocity constant for the first reaction is almost exactly double that of the second, the whole reaction is pseudo-unimolecular; in other words, the formula for unimolecular reactions applies when this relationship holds between the two velocity constants, as the mathematical deductions show.

The esters of camphoric acid, being scarcely soluble in water, were hydrolysed in a mixture of water and methyl alcohol containing different concentrations of hydrochloric acid. The two monoesters are designated as *V* and *E* respectively. In this case the hydrolysis of the diester does not give constants when calculated as a reaction of the first order; the constant for the hydrolysis of the *E* ester is about fifty times greater than that of the *V* ester at 45°; hence, when the diester is hydrolysed, one group is split off rapidly, the other slowly, and a mixture is obtained containing a large proportion of the *V* ester. The method may be used for the preparation of the *V* ester.

For one and the same acid, the rate of hydrolysis is not greatly influenced by the substituting alkyl group, but the velocity is greatly influenced by the nature of the acid. The temperature-quotient for 10° for all the reactions considered lies between 2·6 and 3·1. The rate of hydrolysis is throughout proportional to the concentration of the hydrochloric acid.

It is shown that the different theories of hydrolysis so far suggested are in many respects unsatisfactory, and an attempt is made to account for the above results on a kinetic basis. G. S.

New Method of Mathematically Harmonising the Weights of the Elements, together with a Review of Kindred Work, and Some Observations Concerning the Inert Gases and Satellites. F. H. LORING (*Chem. News*, 1909, 99, 148—151).—Following a brief review of previous attempts to arrive at some plan or formula which would classify the elements, the author describes a newly-devised mathematical treatment of this question.

This method is based on two simple operations; the first being to arrange the elements in a regular series that passes through a zero, according to the empirical equation $\pm(4P)+K=W$, P representing a number of an integral series, 0, 1, 2, 3. . . etc., and K a constant of somewhat arbitrary selection. This equation gives the value W approximating to the true atomic weight by a plus or minus difference ranging from 0 to 0·9. The second operation consists in projecting the differences between the calculated and actual atomic weights, horizontally along a line, on which, by the above equation, the element is placed. By drawing curves through these points, the interesting fact is brought to light, that elliptical curves round two common foci are obtained which intersect practically all the elements and occur in groups of nine.

Nitrogen and glucinum are the only elements which do not fit into this system, the former giving a difference of 1·1 between the observed and the calculated atomic weights, and the latter falling away from any probable curve. It is suggested that these two elements, as well as iodine, each carry a satellite, which, by trial, is found to be about 0·2684. Subtracting this from the atomic weight of nitrogen and glucinum, these elements then fall on curves in a regular manner.

A more fitting position for iodine on one of the curves is found by assuming the true value for this element plus its satellite to be 126 9634 instead of 126·92; subtracting 0·2684 gives a value placing iodine on a curve symmetrical with bromine.

It is thought probable that the calculations made may be at best only approximate, and that some of the curves may require shifting; the agreement, however, between the observed and the corrected values are sufficiently close to make the probability of coincidence impossible.

J. V. E.

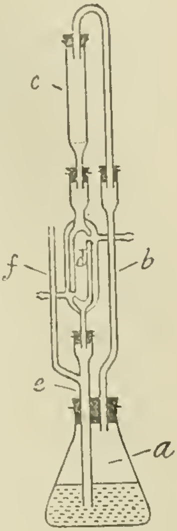
Streams of Gases through Vessels. NICOLAE TECLU (*J. pr. Chem.*, 1909, [ii], 79, 171—173).—An experiment designed to show that a gas only fills a vessel not of uniform diameter if the current is slow, is performed by bubbling air through a bromine solution, and then passing the bromine-laden air through a tube into a balloon provided with a similar tube diametrically opposite. If the current is slow, the vessel is gradually filled with bromine; if fast, the bromine is seen to pass through the balloon as a band, the diameter of which is equal to the diameter of the tube.

W. R.

A Porcelain Vacuum Reservoir for Liquid Air. ERNST BECKMANN (*Zeitsch. angew. Chem.*, 1909, 22, 673).—The well-known glass vacuum reservoir (Dewar's flask) is replaced by one made of porcelain, as there is less danger of breakage during transport.

L. DE K.

An Apparatus for Continuously Extracting Solids. Norman L. Gebhard and F. Bryan Thompson (*Chem. News*, 1909, 99, 124).—The extracting liquid is placed in the flask, *a*, and heated to boiling, when the vapour passes up the tube *b* and enters *c*, which contains the solid to be extracted. After passing through the solid, which is supported on a perforated porcelain disk, the vapour enters the double-surface condenser *d*, where it is condensed and returned to the flask *a*. To guard against the generation of pressure in the apparatus, the return tube, *e*, carries a side-tube, *f*, which is open to the air. If the position of *c* and *d* are interchanged, the solid substance may be extracted by percolation of the cold liquid condensed in *d*. J. V. E.



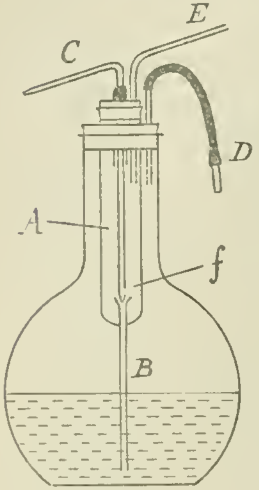
Some Time- and Labour-saving Apparatus in American Chemical Laboratories. Victor Samter (*Zeitsch. Chem. Apparatenkunde*, 1908, 3, 569—573).—These papers contain figures and brief descriptions of mechanical pulverising, ore-sampling, and filtering apparatus in use in certain American analytical laboratories. F. M. G. M.

Arrangement for Filtering Liquids Maintained at Constant Temperature in a Thermostat. Eugenio Morales Chofré (*Anal. Fis. Quim.*, 1909, 7, 50—53).—The liquid, for example a solution in equilibrium with its solid, is contained in a cylindrical lamp-glass, closed at both ends with corks, and immersed in the thermostat. The liquid is kept in motion by a stirrer passing through the upper cork. Through the lower cork a small glass tube passes, which is provided with a wad of filter-paper or glass-wool, and connects by means of india-rubber tubing with a larger glass tube arranged in the thermostat parallel to the lamp-glass. This second tube receives the filtered liquid, which is drawn into it by connecting the upper orifice with a vacuum; the level of the filtered liquid is regulated so as to be below that of the water in the thermostat, so that it is uniformly heated. The receiving tube can be graduated as a pipette to hold a known volume. W. A. D.

A Simple Lecture Experiment to Illustrate Simultaneously Three Stages of Oxidation. John E. Mackenzie (*Chem. News*, 1909, 99, 146).—A somewhat striking demonstration of the change lead peroxide undergoes when heated is effected by sprinkling a thin layer of this substance on to a flat-bottomed, porcelain basin, which is supported on a pipe-clay triangle, and then heating the dish by a Bunsen flame. Where the heat is most intense, litharge is produced, the parts screened by the triangle change to red lead, and in the cooler regions of the dish the unaltered peroxide remains.

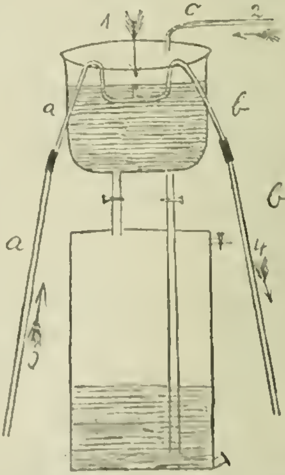
J. V. E.

A Pipette Wash-bottle. P. B. Dallimore (*Pharm. J.*, 1909, [v], 527).—The advantage of the apparatus described and figured is that it renders the washing of a precipitate, etc., by a known quantity of water far more practicable. A small wash-bottle *A*, conveniently made from glass tube, has a piece of ordinary tubing fused through the bottom, the top end of which is slightly opened out above the fused joint so as to allow tube *C* to be ground into it. The latter tube is sealed off at the bottom, and a small hole, *f*, is blown about three-eighths of an inch above the ground glass joint. A slightly larger piece of glass tubing is fastened in the cork for *C* to work in, and a piece of rubber tube is place over the two so as to form a spring to keep *C* down in its place. To use the wash-bottle, tube *C* is slightly raised, and water is forced up *B* into the inner reservoir by blowing down *D* until any desired graduation mark is reached. *C* is then released, the rubber spring making the ground joint water-tight, and by blowing down *E* the measured water may be discharged down to the zero hole *f*.



J. V. E.

Arrangement for Preventing an Overflow in Open Water-fed Gas-holders. Hermann Wüstenfeld (*Chem. Zeit.*, 1909, 33, 412).—It is difficult to arrange a gas-holder so that a long continued, slow current of gas is obtained from it. The following arrangement has been found to obviate the difficulties of regulating the water-supply. An inverted **W**-shaped glass tube, *a* and *b*, has at the centre a small vertical tube. The end *a* of the glass tube is connected with a water-supply, the end *b* with the outflow, and the apparatus is then suspended in the reservoir of the gas-holder, into which a constant stream of water is also flowing; a constant, moderately strong stream of water is then passed through the system *a a b b*. The outflow carries away constant streams of air-bubbles, and the suction thus caused in the small tube suffices to remove from time to time any excess of water in the reservoir.



L. de K.

Inorganic Chemistry.

Behaviour of Fluorine towards Nitrogen, Oxygen, and Chlorine at the Temperature of the Electric Arc and the Induction Discharge. Otto Ruff and Julian Zedner (*Ber.*, 1909, 42, 1037—1046).—Two special pieces of apparatus are described which make it possible to heat fluorine and mixtures of fluorine with other gases at the temperature of the electric arc or of the induction discharge. Fluorine was heated with nitrogen, with oxygen, and with chlorine, but in no case did any reaction take place. E. F. A.

Quadrivalency of Oxygen. John C. Thomlinson (*Chem. News*, 1909, 99, 185).—The conclusions drawn by Redgrove (this vol., ii, 308) are criticised. The increment of oxygen atoms in a molecule accompanied by a lower molecular heat of combustion than would be expected by theory is considered to be probably due to experimental error, and not a valid argument for the quadrivalency of oxygen. J. V. E.

Phosphorescence and Combustion Flames of Sulphur. Léon Bloch (*Compt. rend.*, 1909, 148, 782—783).—The phosphorescence exhibited by sulphur at about 200° is accompanied by the formation of considerable quantities of ozone, but not by any ionisation phenomena. Attempts to isolate a lower oxide of sulphur by passing air over gently heated sulphur and then through a tube immersed in liquid air were unsuccessful. The combustion flame, which replaces the phosphorescence effect when the temperature of sulphur is raised to 360°, is non-conducting, and the oxidation of sulphur dioxide by air in contact with spongy platinum is also unaccompanied by the production of ions. Attention is directed to the difference in the phenomena of oxidation of sulphur and phosphorus. H. M. D.

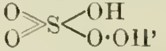
Purification of Hydrated Sulphuric Acid from Arsenic by Cooling. Morancé (*Compt. rend.*, 1909, 148, 842—843).—The author exposed Glover tower acid of 63·5° Baumé, prepared from Spanish pyrites, to a temperature varying from −8° to 2° for twenty-four hours. It was then found that, of 3730 grams of acid taken, 1895 grams had solidified in the form of crystals, whilst the rest remained liquid. The impurities present in these two forms, calculated as grams per 100 grams of monohydrated acid, were:

	Solid.	Liquid.
Residue at a red heat............	0·281	0·829
Iron and aluminium	0·029	0·119
Arsenic..........................	0·033	0·368

T. H. P.

Synthesis and Formula of Caro's Acid (Monopersulphuric Acid). Hermann Ahrle (*J. pr. Chem.*, 1909, [ii], 129—164. Compare Lowry and West, Trans., 1900, 77, 950; Baeyer and Villiger, Abstr., 1901, ii, 380; Armstrong and Lowry, 1902, ii, 558; Price, Trans., 1906, 89, 53).—The results of previous investigations has led to the conclusion that Caro's acid is either H_2SO_5 or $H_2S_2O_9$, the acid in the former case being monobasic, and in the latter, dibasic. This uncertainty would be removed if the acid or one of its salts could be obtained in a state of purity. The present investigation deals with an attempt to prepare the free acid from hydrogen peroxide and either sulphuric acid or sulphur trioxide, as Price (*loc. cit.*) failed to obtain a pure potassium salt. The reaction $H_2O_2 + H_2SO_4 \rightleftharpoons H_2SO_5 + H_2O$ is a reversible one, and if the free acid is to be obtained, water must be carefully excluded. This has been done as far as possible by mixing sulphur trioxide and 100% hydrogen peroxide; above −10° the action becomes visible, the crystals gradually disappear with development of heat. In this way a 92·3% monopersulphuric acid was obtained, and which also contained 6% of hydrogen peroxide. Experiments in which the materials were added in molecular proportions gave an 80—85% acid.

Further experiments to show the equilibrium between hydrogen peroxide and sulphuric acid gave the result that equilibrium is reached when two-thirds of the monopersulphuric acid is formed.

The synthesis and kinetic experiments lead to the conclusion that the acid has the constitution  $\begin{matrix}O\\O\end{matrix}\!\!>\!S\!<\!\begin{matrix}OH\\O\cdot OH\end{matrix}$, the hydrogen of the hydroxyl attached to the sulphur being the replaceable hydrogen atom. At the ordinary temperature, monopersulphuric acid is a mobile liquid, and above 0° slowly decomposes. It decomposes explosively with catalysts, such as finely-divided platinum or silver, but lead or zinc dust are without vigorous action. Cellulose and wool are instantaneously decomposed.

Full details are given for the preparation of 100% hydrogen peroxide.

W. R.

Hydroxylamine. FRITZ HABER (*J. pr. Chem.*, 1909, [ii], 79, 173—176. Compare Abstr., 1897, ii, 23).—The observation of the author that hydroxylamine is reduced quantitatively to ammonia by alkaline ferrous solution has been contradicted by Ebler and Schott (Abstr., 1908, ii, 1029), who found that nitrogen and nitrous oxide were also evolved. This discrepancy is explained by the fact that the author used dilute hydroxylamine solution, whereas Ebler and Schott probably used concentrated. Further experimental evidence is given in support of the quantitative production of ammonia in such dilute solutions, and the conclusion is drawn that this result is in harmony with the aminoxide structure $O\!:\!NH_3$, and against the constitution $NH_2\cdot OH$.

W. R.

Anhydrous Hydronitric Acid [Azoimide]. I. Electrolysis of a Solution of Potassium Trinitride [Azoimide] in Hydronitric Acid [Azoimide]. ARTHUR W. BROWNE and G. E. F. LUNDELL (*J. Amer. Chem. Soc.*, 1909, 31, 435—448).—Since anhydrous ammonia and hydrazine are poor conductors of electricity and are capable of acting as ionising solvents, it has been considered of interest to study the behaviour of anhydrous hydronitric acid [azoimide].

Anhydrous hydronitric acid has been prepared by Dennis and Isham's method (Abstr., 1907, ii, 165), and experiments are described which indicate that the pure substance offers a very high resistance to the electric current and has a specific conductivity approximately equal to that of pure ammonia. On dissolving potassium trinitride in the anhydrous acid, the conductivity is greatly increased, and when such a solution is electrolysed, nitrogen and hydrogen are evolved in a ratio which is approximately 3 : 1, but somewhat less under certain conditions. Ammonia is formed during the electrolysis, but hydrazine is not produced. In the course of the experiments, certain phenomena were observed which might have been caused either by traces of ozone or by the formation of small quantities of a polymeride of nitrogen, N_3 or N_6 (compare Szarvasy, Trans., 1900, 77, 607). E. G.

Atomic Weight of Arsenic. Analysis of Silver Arsenate. Gregory P. Baxter and Fletcher Barker Coffin (*J. Amer. Chem. Soc.*, 1909, **31**, 297—309).—The method depends on the conversion of silver arsenate into silver chloride or bromide. Samples of the arsenate were prepared by adding to a dilute *N*/15-solution of silver nitrate an equivalent amount of an alkali arsenate in corresponding dilution in a room lighted only with ruby light. There is some evidence that in these circumstances trisodium arsenate gives rise to a slightly basic silver triarsenate, whilst disodium ammonium arsenate and disodium hydrogen arsenate give rise to the normal salt. The precipitates were washed by decantation, partly dried by centrifugal action, and then heated in an electric oven at 130° for some time.

Two methods were employed in converting the silver arsenate into chloride. By the first method, the arsenate, in a quartz tube, was heated for seven to eight hours in a stream of dry air at 250°, then weighed, and finally heated in a current of dry hydrogen chloride for some hours until the reaction was practically complete. Small corrections had to be made for the traces of arsenic still remaining after prolonged heating, and also for the traces of moisture remaining after heating the arsenate for some hours at 250°. The second method consisted in heating the arsenate in a platinum boat, and, after weighing, dissolving in nitric acid and precipitating as silver chloride or bromide. In this case, a small residue insoluble in dilute nitric acid was found to be soluble in concentrated acid.

The specific gravity of silver arsenate was determined by displacement of toluene; D_4^{25} 6·657.

The ratio $3AgCl : Ag_3AsO_4$ has been determined in 15 analyses, and the ratio $3AgBr : Ag_3AsO_4$ in 11 analyses. The mean of the most trustworthy results gives As = 75·02 for Ag = 107·93; As = 74·96 for Ag = 107·88, and As = 74·92 for Ag = 107·85 [O = 16]. G. S.

The System Sulphur–Arsenic. W. P. A. Jonker (*Zeitsch. anorg. Chem.*, 1909, **62**, 89—107).—Arsenic remains unmelted at about 800°. A mixture having the composition of realgar, As_2S_2, melts at 321° to a thin liquid; the freezing point is lowered by the addition of either sulphur or arsenic, the viscosity being greatly increased at the same time, the addition of 5% of sulphur rendering the mass so viscous that crystallisation does not take place on cooling. On the arsenic side, the eutectic point is at 310°. Natural orpiment, As_2S_3, melts at about 310°; an artificial preparation of this composition does not crystallise on cooling. A few points on the sulphur side of the curve have been determined by mixing sulphur and realgar, and measuring the temperature at which the mass becomes rigid on cooling. This does not give the freezing point, but the curve has a similar form to the freezing-point curve.

The sublimation point of arsenic in an open vessel is 616° (Krafft and Knocke, this vol., ii, 211, give 554—556°). A saturated solution of arsenic in realgar boils at 534°, and natural or artificial orpiment at 707°. By analysing the vapour in contact with the boiling liquid, the sublimation curve has been determined, and its form shows that As_2S_2 is very largely dissociated in the vapour (compare Szarvasy and Messinger, Abstr., 1897, ii, 404). On the other hand, As_2S_3 distils unchanged. The curves do not indicate the formation of As_2S_5.

A diagram is given in which the above results are collected.

C. H. D.

Preparation of a Boron Carbide. Samuel A. Tucker (D.R.-P. 206177).—A boron carbide corresponding with the formula B_6C was prepared by heating at about 2500° in the electric furnace a mixture of carbon and boric anhydride containing excess of the latter; when the current was gradually diminished, so that the material was cooled very slowly, the product was obtained in a crystalline form.

F. M. G. M.

Action of Gaseous Hydrogen Chloride on Amorphous Silicon. Adolphe Besson and L. Fournier (*Compt. rend.*, 1909, **148**, 555—557).—When dry hydrogen chloride is passed over heated amorphous silicon, products are obtained which are condensed with difficulty. It was found convenient to absorb these in silicon tetrachloride cooled by means of solid carbon dioxide. By fractional distillation of the solution, the compounds SiH_3Cl, which boils at about −10°, and SiH_2Cl_2, which boils at about +12°, were obtained in appreciably pure condition. Both these chlorides are colourless, mobile liquids, which have a large coefficient of expansion, and are decomposed by water and alkalis with evolution of hydrogen. A sulphur compound boiling at about −25° was also obtained in small quantity; the formation of this is attributed to the presence of sulphur as an impurity in the amorphous silicon.

With the object of preparing the above compounds, silicon tetrachloride vapour was passed over calcium hydride heated to a temperature below redness. The products obtained, however, were hydrogen, hydrogen chloride, silico chloroform, calcium chloride, and either calcium silicide or amorphous silicon, depending on the temperature. At a relatively low temperature and with excess of calcium hydride, calcium silicide is formed, whereas at a higher temperature and with excess of silicon tetrachloride amorphous silicon is obtained.

H. M. D.

Preparation of Silicon Chlorides of the Silicomethane Series. ADOLPHE BESSON and L. FOURNIER (*Compt. rend.*, 1909, 148, 839—842).
From the mixed silicon chlorides obtained by the action of an electric discharge on a mixture of hydrogen and silicomethane, the authors have separated the following compounds. (1) Silicon tetrachloride. (2) Hexachlorosilicoethane. (3) Octachlorosilicopropane, b. p. 215—218° (Gattermann and Weinlig, Abstr., 1894, ii, 414, gave b. p. 210—215°), which, after solidification, has m. p. −67°. (4) *Dodecachlorosilicopentane*, Si_5Cl_{12}, which is a colourless, oily liquid, b. p. about 150°/15 mm., fumes in the air, is readily decomposed by water, giving a white product resembling silica, and often gives off sparks and ignites when gently rubbed. (5) *Tetradecachlorosilicohexane*, Si_6Cl_{14}, which is a white solid, m. p. 170° (decomp.), subliming in a vacuum at about 200°, giving crystals which later assume a waxy consistency; it is readily decomposed by water, giving a white, combustible substance.

After the above compounds have been removed by prolonged heating at 200—210° in a vacuum, there remains a solid, reddish-yellow, glassy mass, which is almost entirely soluble in light petroleum or carbon tetrachloride, and is apparently a mixture of a number of chlorides. T. H. P.

Thermal Effects of the Musical Arc. Probable Fusion of Carbon. M. LA ROSA (*Compt. rend.*, 1909, 148, 475—478).—As there is some evidence that the singing arc is more powerful than the ordinary arc, the author has attempted to fuse carbon by means of the former. Sugar charcoal was exposed to the musical arc between carbon electrodes for some hours, and in the residue particles of graphite, showing under the microscope no trace of the contours of the original charcoal, were observed. This appears to indicate the fusion of carbon, more particularly as the ordinary arc under corresponding conditions did not produce the same effect (compare this vol., ii, 311). G. S.

Decomposition of Carbon Tetrachloride Vapour in the High Tension Electric Arc. CARL SCHALL (*Zeitsch. physikal. Chem. Unterr.*, 1908, 21, 385—387).—An apparatus suitable for demonstration purposes, in which a high-tension electric arc is passed through the vapour of carbon tetrachloride, is described and figured. Clouds of soot are immediately formed, and a considerable proportion of free chlorine is obtained. In one experiment, 100 grams of the pure tetrachloride were subjected for a considerable time to the action of the arc, and, besides chlorine and carbon, hexachlorobenzene was detected in the residue. G. S.

Formation of Graphitic Acid and the Definition of Graphite. GEORGES CHARPY (*Compt. rend.*, 1909, 148, 920—923).—For the preparation of graphitic acid, Brodie's reagent, fuming nitric acid, and potassium chlorate may be replaced by other oxidising mixtures, such as concentrated sulphuric acid with potassium permanganate or chromic acid. The reaction proceeds at the ordinary temperature, and is accelerated by heat, although with loss of carbon as carbon dioxide. Specimens of carbon hitherto considered amorphous (carbon from steel and the product obtained by heating graphitic acid) also yield graphitic acid on oxidation. The definition of graphite, which depends on the action of these oxidising agents, is therefore unsatisfactory.

The density of the above specimens of carbon was found to be 2·25 after compression; they should consequently be classed as true graphites (compare Le Chatelier and Wologdine, Abstr., 1908, ii, 177).
W. O. W.

Atomic Weight of Potassium. GUSTAVE D. HINRICHS (*Compt. rend.*, 1909, **148**, 484—485).—From the recent experiments of Lenher (this vol., ii, 230) on the atomic weight of tellurium by the decomposition of potassium telluribromide, the author shows that on his theory (compare Abstr., 1907, ii, 945) the atomic weight of potassium is $39\frac{1}{8} = 39{\cdot}125$.
G. S.

Alcoholic Potash. A. VAN RAALTE (*Chem. Weekblad*, 1909, **6**, 252—253. Compare Scholl, Abstr., 1908, ii, 425; Rabe, Abstr., 1908, ii, 689).—Alcoholic potash, prepared by Rabe's method, may keep in Batavia, but not in Holland. By suspending 35 grams of potassium hydroxide sticks in a muslin bag in a litre of 96% alcohol until solution is complete, filtering, and preserving the solution in a brown stoppered bottle, alcoholic potash, which remains colourless for at least six months, is obtained. At the end of that period its titration value was unaltered.
A. J. W.

Impossibility of Judging of Relative Stabilities of Corresponding Compounds of Silver and Lead from Thermochemical Data. ALBERT COLSON (*Compt. rend.*, 1909, **148**, 837—839).—The relations between the heats of formation of silver and lead carbonates and nitrates, either from their constituent elements or from the oxides into which they decompose on heating, indicate that lead nitrate and carbonate should be more stable than the corresponding silver compounds. This is found to be the case with lead carbonate, which attains a dissociation pressure of 760 mm. at 285°, whilst the silver salt gives this pressure at 220°.

The nitrates, however, exhibit different behaviour. Lead nitrate does not decompose at 200°, as is stated in the text-books. When it is perfectly dried by prolonged heating in a vacuum at a temperature higher than 200°, it shows no trace of decomposition when heated at 260° under a pressure of 2 mm., and it is not until a temperature of 283° is reached that the salt is observed to decompose. Dry silver nitrate, on the other hand, undergoes no decomposition when heated at 350° in a vacuum.

The heat of formation of lead nitrate is less in the dissolved than in the free state, but it is found that the stability of the salt is increased considerably by dissolving it in silver nitrate.
T. H. P.

Alloys of Calcium and Silicon. S. TAMARU (*Zeitsch. anorg. Chem.*, 1909, **62**, 81—88).—The alloys were prepared from calcium and silicon in an atmosphere of nitrogen, some calcium nitride being always formed. The vessels used were of carbon or of porcelain, lined in either case with a layer of magnesia mixed with a little tar and burnt. Silicon is practically insoluble in molten calcium at 900°. At 990° a reaction takes places, having a maximum value in the alloy containing 60% Si corresponding with the compound $CaSi_2$. The formula of the compound was not certainly established, and it is possible that another silicide is also formed. The alloys rich in calcium always contained magnesium, derived from the lining by reduction.

The alloys are scarcely attacked by alkalis, more readily by acids. Those containing 38—52% Si react violently with dilute acids, yielding a spontaneously inflammable gas, which, if collected over water, loses its power of spontaneous ignition in a few minutes. Concentrated acids give a gas which is not spontaneously inflammable.

C. H. D.

Dissociation of Calcium Carbonate. D. ZAVRIEFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, i, 34—56. Compare Abstr., 1907, ii, 768).—Further experiments on this reaction show that within the limits of temperature 700—950° no intermediate phase is formed, as might have been expected from Raoult's experiments (Abstr., 1881, 348; 1882, 695), and from the fact that the reaction is completely reversible within these limits. At low temperatures the reaction proceeds slowly, the velocity depending greatly on the condition of the surface of the lime, so that accurate investigation is impossible. It cannot be stated with certainty that intermediate products are not formed at 500—600°, at which temperatures, also, solid solutions may be formed. With a considerable excess of lime, when presumably solid solutions with a small content of carbon dioxide are formed, the dissociation pressure is very much less than when calcium carbonate alone is used.

T. H. P.

Calcium Alkali Sulphates. JOH. D'ANS [with O. SCHREINER] (*Zeitsch. anorg. Chem.*, 1909, 62, 128—167. Compare Abstr., 1906, ii, 751; 1907, ii, 168, 459; 1908, ii, 104, 182, 590).—The regions of existence of all the calcium alkali sulphates have been determined between 0° and 100°. Sodium occupies a separate position in the alkali metal series; ammonium takes its place between potassium and rubidium.

The solubility curve of sodium sulphate is little altered by saturation with calcium sulphate. In addition to glauberite,

$$CaSO_4,Na_2SO_4,$$

a labile double salt exists, and is always formed first under the conditions of formation of glauberite. It may remain long in a metastable condition, but changes into glauberite if inoculated with crystals of the latter. Direct analysis gives the composition

$$CaSO_4,2Na_2SO_4,2H_2O$$

for the labile salt (compare Cameron, Bell, and Robinson, Abstr., 1907, ii, 648).

The results with potassium calcium sulphates are in agreement with those of van't Hoff (Abstr., 1905, ii, 319). Experiments at 140—170° failed to indicate the formation of a potassium dicalcium sulphate, which has been isolated from mixtures of the fused salts.

Ammonium forms double salts of all the three types, syngenite, pentacalcium sulphate, and dicalcium sulphate. Of the five transition points, two have been determined by tensimetric measurements, and two more from the results of solubility measurements; the fifth probably lies below the eutectic point. Two of the three transition points have also been determined for the calcium rubidium sulphates.

In view of the fact observed by van't Hoff (Abstr., 1904, ii, 34) that gypsum does not form syngenite in a solution saturated with sodium and potassium chlorides, the author has studied the influence of various salts on the solubility of syngenite at 25°. The limit gypsum-syngenite is found to be 3·223 mols. K_2SO_4 and 0·223 mol. $CaSO_4$ in 1000 mols. solution. Potassium salts lower the SO_4-concentration. The "activity" of potassium salts in equal concentrations follows the diminishing order KOH, $C_2H_3O_2K$, the three halides, KNO_3, $KClO_3$, $KClO_4$, $K_4Fe(CN)_6$. The order of activity of sodium salts and of acids is exactly the opposite of that of potassium salts; it depends in these cases on the affinity of the anion. Other sulphates give irregular results. Sucrose is practically without influence.

The results are represented graphically and discussed theoretically.

C. H. D.

Occluded Gases present in Certain Common Metals. B. Delachanal (*Compt. rend.*, 1909, **148**, 561—564).—The metals were heated to a bright red heat in an exhausted porcelain tube and the gases pumped off for analysis. From aluminium, prepared by the reduction of the double fluoride of sodium and aluminium, hydrogen alone was obtained; from magnesium, hydrogen and carbon monoxide; from zinc, hydrogen, carbon monoxide, and carbon dioxide; from tin, platinum sponge, commercial platinum and platinum-iridium, hydrogen, methane, carbon monoxide, carbon dioxide, and nitrogen.

H. M. D.

Action of Magnesium on Carbon Monoxide. Camille Matignon (*Bull. Soc. chim.*, 1909 [iv], **5**, 269—270).—Conflicting statements have been made in the literature regarding this reaction. The author finds that burning magnesium powder reacts very vigorously with carbon monoxide, carbon and magnesium oxide being produced.

C. S.

Hardness of Magnesium-Silver Alloys. Wladimir I. Smirnoff and Nicolai S. Kurnakoff (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 108. Compare Kurnakoff and Schemtschuschny, Abstr., 1908, ii, 932).—The minimum conductivity (36×10^{-4}) for magnesium-silver alloys occurs at the composition Mg_3Ag, with which also corresponds the maximum hardness, 180 kilos. per sq. mm. In consequence of the formation by the argentide MgAg of solid solutions with excess of magnesium (36—50% atom silver) and silver (50—60% atom silver) (compare Schemtschuschny, Abstr., 1906, ii, 539), this substance exhibits a relative minimum hardness, namely, 76 kilos. per sq. mm. The formation of solid solutions of magnesium in silver (*loc. cit.*) is accompanied by an increase of the hardness from 26 (pure silver) to 109 kilos. per sq. mm. (70·16% atom silver).

T. H. P.

The System Silicon-Magnesium. PAUL LEBEAU and P. BOSSUET (*Rev. Métallurgie*, 1909, 6, 272—278).—Alloys of magnesium and silicon have been prepared by fusing the components together under a layer of potassium silicofluoride, or by heating magnesium with potassium silicofluoride. Microscopical examination shows that only one silicide is formed having the formula Mg_2Si, and a slate-blue surface colour; D 2. It decomposes water slowly at the ordinary temperature, liberating hydrogen, whilst in acids a mixture of hydrogen and hydrogen silicide is formed. The two eutectics of the series contain about 2% and 50% of silicon respectively. C. H. D.

The System: Copper Sulphate, Copper Chloride, Ammonium Sulphate, Ammonium Chloride and Water at 30°. FRANS A. H. SCHREINEMAKERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 11, 615—620).—A method is described for the special representation of the various saturated solutions which are formed from the above four-component system. The substances which may occur as solid phases at 30° in contact with solution are: $CuSO_4,5H_2O$, $CuCl_2,2H_2O$, $(NH_4)_2SO_4$, NH_4Cl, and the double salts $CuSO_4,(NH_4)_2SO_4,6H_2O$ and $CuCl_2,2NH_4Cl,2H_2O$. From the solid figure it follows that the double salt $CuSO_4,(NH_4)_2SO_4,6H_2O$ can co-exist with $(NH_4)_2SO_4$, NH_4Cl, $CuSO_4,5H_2O$, and $CuCl_2,2NH_4Cl,2H_2O$, but not with $CuCl_2,2H_2O$. Similarly, $CuSO_4,5H_2O$ can co-exist with $CuCl_2,2H_2O$, and each of the double salts, but not with $(NH_4)_2SO_4$ or NH_4Cl. Both double salts behave in regard to each other and to water as single substances; for each there is a series of saturated solutions, and there is a particular solution which is saturated with respect to both.

H. M. D.

Influence of Small Quantities of Elements in Copper on its Reactions with Nitric Acid. JOHN H. STANSBIE (*J. Soc. Chem. Ind.*, 1909, 28, 268—274).—The investigation is a continuation of previous work (Abstr., 1908, ii, 497), and deals particularly with the influence of small quantities of arsenic, phosphorus, and lead on the reactions of alloys of these elements with copper when the alloys are dissolved in nitric acid, D 1·2, the reactions taking place at a temperature of 65°. The results confirm the view that the chief cause of the decrease in the volume of nitric oxide liberated by the dissolution of copper alloys in nitric acid is the formation of a solid solution of the added element, or of a compound of that element, in the excess of copper. The maximum effect of phosphorus on the chemical relations of copper appears to be produced by a phosphorus-content of about 0·025%. Small percentages of lead exert little or no influence on the reactions of copper with the acid, so that lead acts similarly to bismuth in this respect, and it is also shown that a small quantity (0·1%) of copper in lead has little or no influence on the reactions of lead itself. It may be noted that the quantities of phosphorus, arsenic, antimony, and bismuth which produce the maximum effect are in the order of their atomic weights, and it may be that the atomic volume of the added element is a factor in the influence it exerts upon the copper.

W. P. S.

A Thiobasic Mercuric Sulphate. Knud Estrup (*Zeitsch. anorg. Chem.*, 1909, 62, 168—170).—When a solution of mercuric sulphate, prepared by dissolving 10 grams of yellow mercuric oxide in 10 c.c. of concentrated sulphuric acid and 40 c.c. of water, is shaken with one-fourth its volume of carbon disulphide and allowed to remain for several weeks, large crystals are obtained. After washing with dilute sulphuric acid, alcohol, and ether, snow-white, hexagonal plates are obtained, having the composition $4HgO,2HgS,3SO_3,4H_2O$. On boiling with potassium iodide, mercuric sulphide is precipitated and two equivalents of alkali are set free. Assuming the constitution given by Biilmann (Abstr., 1900, i, 431) for mercuric sulphate, the new compound is thus formed:

$$3\,OH{\cdot}Hg{\cdot}SO_4{\cdot}Hg{\cdot}OH + CS_2 = CO_2 + 2H_2O + \begin{matrix}HO{\cdot}Hg{\cdot}SO_4{\cdot}Hg{\cdot}S{\cdot}Hg\\ HO{\cdot}Hg{\cdot}SO_4{\cdot}Hg{\cdot}S{\cdot}Hg\end{matrix}\!>SO_4.$$

C. H. D.

Extraction of Rare Earths from Mariupolite. Józef Morozewicz (*Bull. Acad. Sci. Cracow*, 1909, 207—213).—The dyke modification of the rock mariupolite (Abstr., 1902, ii, 668; 1905, ii, 177) contains rare earths of the cerium group and of the tantalum group, the former being present in beckelite (which forms about 0·3% of the rock) and the latter in pyrochlore (0·2%). The fact that beckelite is decomposed by dilute hydrochloric acid enables the cerium earths to be readily separated and converted into the oxalates, and by digesting the insoluble portion with sulphuric and hydrofluoric acids the tantalic and columbic acids and also the zircon can be isolated. Full details of the method of procedure are given. The yields were:

$(Ce,La,Di,Y,Er)_2O_3$, 0·21 and 0·07%; Cb_2O_5, 0·16%; zircon, 1·70%.

L. J. S.

The Odour of Clay. Paul Rohland (*Zeitsch. physiol. Chem.*, 1909, 59, 325—326).—The odour and taste of clay are due to organic admixture, and are least noticeable in clays most free from such impurity. In some of the Saxon clays this is of a fatty nature, whilst in others from Silesia it is in the form of hydrocarbons, the variable nature of the organic matter influencing the odour of the clay. That it is not chemically united to the clay is shown by the fact that it can be transferred to another (colloidal) substance. If clay is shaken with a solution of ferric sucrate ($yC_{12}H_{22}O_{11},xFeH_6O_6$), the clay loses both odour and taste, which are acquired by the sucrate solution.

W. D. H.

Structure of Tempered Steel. W. A. Kurbatoff [in part, with M. M. Matvéeff] (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 1—17).—Metallographic study of steels treated in various ways leads to the following results.

The best method of preparing austenite is to temper steel containing 1·8—2·2% of carbon, heated nearly to its melting point, either in mercury at 130° or in mercury at the ordinary temperature with subsequent softening at 130°. The substance between the crystals of austenite consists of troostosorbite (*fer de lance*), and that forming a network from the centres of crystallisation, troostite. The old scheme representing the transformation of austenite $\longrightarrow$ martensite $\longrightarrow$ troostite $\longrightarrow$ sorbite $\longrightarrow$ perlite is inaccurate. The equilibrium austenite $\rightleftarrows$ sorbite is displaced from right to left at 90—150° and above 1000°, whilst the opposite change takes place at 150—750°, the velocity of this transformation passing through its first maximum at 250°. It is probable that austenite is a carbide of iron,

$$Fe_7C\ ?\ (Fe_6C - Fe_{10}C),$$

the molecules of which are stable at 1000°, whilst troostite and sorbite are apparently solutions (β and α) of carbon in iron.

T. H. P.

Action of Coke on Ferric Chloride and Auric Chloride in Solution. ALFRED TINGLE (*J. Amer. Chem. Soc.*, 1909, **31**, 461—463).—It has been stated by Oechsner de Coninck (Abstr., 1900, ii, 485) that when solutions of auric, platinic, or ferric chloride are filtered through animal charcoal or powdered coke, the metal is completely retained by the filter. Experiments are now described on the action of powdered coke on solutions of auric chloride, ferric chloride, and basic ferric chloride. In some instances, the coke was first purified by washing with hydrochloric acid, and in others it was not so treated. In the case of the ferric chloride solutions, the iron was always partly reduced to the ferrous state, whilst in the case of the auric chloride solution a large proportion of the gold was retained by the filter. These results are considered to be due, chiefly or entirely, to the sulphur compounds present in the coke.

E. G.

Ferric Nitrates at 25°. FRANK K. CAMERON and WILLIAM O. ROBINSON (*J. Physical Chem.*, 1909, **13**, 251—255).—Ferric nitrate solutions were shaken with freshly precipitated ferric hydroxide or with excess of nitric acid for four months at 25°. The liquid and solid phases were then analysed.

Application of the graphic method to the results shows that there are no definite basic nitrates of iron; the various compounds which have been described as such were solid solutions of ferric oxide, nitric acid, and water. When nitric acid is in excess, the yellow, crystalline hydrate, $Fe_2O_3,3N_2O_5,18H_2O$, is formed. In two cases a colourless, crystalline pernitrate, apparently $Fe_2O_3,4N_2O_5,18H_2O$, was obtained, but later attempts to produce this salt failed.

R. J. C.

Action of Carbon Monoxide on Chromium, Nickel, Manganese, and their Oxides and Alloys. GEORGES CHARPY (*Compt. rend.*, 1909, **148**, 560—561).—The action of carbon monoxide on the metals and oxides was investigated at 1000°. Nickel is practically unaltered, although carbonisation appears to take place to a very small extent; the oxide is completely reduced to metal. Manganese and ferro-manganese are oxidised with formation of manganous oxide, carbon being deposited; at first the gas is completely absorbed, carbon dioxide being evolved at a later stage. The oxide, Mn_3O_4, is reduced to manganous oxide. Chromium behaves like manganese, but the action takes place much more slowly; chromic oxide is unacted on. In the case of steel containing a small percentage of chromium, both metals are acted on by the carbon monoxide as they would be if the metals were separate. A portion of the carbon liberated in the oxidation of the chromium is used up in the carbonisation of the iron. When the amount of chromium present exceeds 7%, this action does not take place. H. M. D.

Speed of Oxidation, by Air, of Uranous Solutions. Volumetric Estimation of Uranium. HERBERT N. McCOY and HERBERT N. BUNZEL (*J. Amer. Chem. Soc.*, 1909, **31**, 367—373).—The rate of oxidation by air of an acid solution of uranous sulphate has been measured by drawing a current of air through the solution, and titrating portions of it at intervals with permanganate. The velocity is proportional to the concentration of the salt, inversely proportional to the square of the hydrogen ion concentration, and is only slightly diminished by the addition of zinc sulphate.

The oxidation-reduction potential of a solution containing uranous and uranyl salt and some free sulphuric acid has been measured.

In estimating uranium salts by reduction to uranous salts with zinc and acid, and titration with permanganate, oxidation by free oxygen is a source of error, but accurate results are obtained by the following procedure. Fifty c.c. of pure uranyl sulphate solution (=about 0·3 gram uranium), 55 c.c. of water, and 20 c.c. of concentrated sulphuric acid (D=1·84) are poured on 100 grams of zinc in sticks, the solution is heated nearly to boiling, after fifteen minutes it is filtered, the zinc washed with cold $3N$-acid, the solution made up to 300 c.c., and titrated with $N/10$-permanganate. G. S.

Titanium Nitride. OTTO RUFF (*Ber.*, 1909, **42**, 900).—Although the estimation of nitrogen in the easily decomposable titanium halogen nitrides (compare Abstr., 1908, ii, 700) can be carried out either by Dumas' method or by decomposing the nitride with boiling potassium hydroxide, the latter method is not applicable when pure titanium nitride is used, as the action is very slow.

Pure titanium nitride is best prepared from the dioxide and ammonia by heating in a porcelain tube at 1400—1500° during four to six hours. W. R.

Hydrolytic Dissociation of Bismuth Chloride. RENÉ DUBRISAY (*Compt. rend.*, 1909, **148**, 830—832).—The author has studied the course of the hydrolytic dissociation of bismuth chloride, in order to ascertain whether this reaction is rightly expressed by the equation: $BiCl_3 + H_2O = BiOCl + 2HCl$. The reaction should be divariant, and, since it is exothermic, a rise of temperature should correspond with a diminution in the degree of dissociation.

Investigation of the equilibria at 18°, 80°, and 85° and for various concentrations, leads to curves which are continuous, and thus show that only one oxychloride is formed; the curves also indicate a fall in the dissociation as the temperature rises. T. H. P.

Action of Ammoniacal Hydrogen Peroxide on Bismuth Salts. ALEXANDER GUTBIER and R. BÜNZ (*Chem. Zentr.*, 1909, i, 732—733; from *Sitzungsber. physikal. med. Soz. Erlangen*, 1909, 40, 90—95. Compare Abstr., 1906, ii, 174, 234, 551, 678; 1907, ii, 181; 1908, ii, 701).—The yellow, or orange, precipitate obtained by adding a large excess of hydrogen peroxide to an acid solution of bismuth nitrate, and filtering in small portions into concentrated ammonia, is not a peroxide, as stated by Hasebroek (Abstr., 1887, 340), since it is completely soluble in concentrated nitric acid, and contains only traces of active oxygen, whether dried at 120° or at a low temperature. It contains 95% Bi_2O_3. The yellow colour indicates that it is not a basic hydroxide, $BiO{\cdot}OH$. C. H. D.

[Preparations containing Colloidal Gold.] LES ETABLISSEMENTS POULENC FRÈRES (D.R.-P. 206343).—The aromatic amines, such as aniline and α-naphthylamine, reduce solutions of auric chloride, giving precipitates of pulverulent black gold.

When this chloride is reduced with sodium sulphanilate, naphthionate, or *p*-aminophenylarsinate (atoxyl) in solutions rendered slightly alkaline with sodium hydrogen carbonate, a stable solution of colloidal gold is produced. The grey residue obtained by evaporating the solution to dryness in a vacuum dissolves completely in water to a solution having the ruby-red colour characteristic of colloidal gold. The solution obtained with atoxyl (10%), gold chloride, and sodium hydrogen carbonate is of therapeutic interest. These colloidal solutions are stable towards dilute alkalis, but the carbonates and chlorides of the alkaline-earth metals, and the salts of the heavy metals induce precipitation of the gold. F. M. G. M.

Atomic Weight of Palladium. I. Analysis of Palladosammine Chloride. ALEXANDER GUTBIER, A. KRELL, and M. WOERNLE (*J. pr. Chem.*, 1909, [ii], 79, 235—252).—After a careful examination of numerous palladium compounds, the authors select palladosammine chloride, $Pd(NH_3)_2Cl_2$, as being the only suitable material for the determination of the atomic weight of palladium. It is easily obtained by various methods, is readily purified, and does not retain a trace of water. For its preparation, pure palladium is dissolved in hydrochloric and nitric acids, and the solution is evaporated repeatedly on the water-bath with hydrochloric acid. The residue is dissolved in the smallest possible quantity of hydrochloric acid, and the solution filtered into a platinum basin containing an excess of ammonium hydroxide. By prolonged warming on the water-bath, the precipitated Vauquelin's salt is redissolved. The clear yellow solution is saturated with hydrogen chloride, and the yellow, crystalline palladosammine chloride washed thoroughly with water. The process of solution in ammonium hydroxide, reprecipitation by hydrochloric acid and washing, is thrice repeated, and the resulting chloride is dried for seventy hours in a vacuum and finally at 105—110° to constant weight.

In the first set of experiments, palladosammine chloride is decomposed by ignition in a current of hydrogen (from platinised zinc and dilute sulphuric acid), and the hydrogen retained by the spongy palladium is removed by heating to a temperature exceeding 150° in a current of carbon dioxide. The mean of five experiments gives the value $106{\cdot}64 \pm 0{\cdot}03$.

A second set of experiments is performed by Amberg's electrolytic method. The cathode is a weighed platinum dish, the anode a polished disk of platinum–iridium (10% Ir). The electrolyte is palladosammine chloride dissolved in dilute sulphuric acid at 60—65°. The current is 0·05—0·04 ampere, and the potential 0·75 volt, which must not exceed 1·25 volts. The platinum dish after being washed with water and alcohol is dried at 110—120°. The mean of five experiments gives the value $106{\cdot}65 \pm 0{\cdot}02$ ($O = 16$). C. S.

Iridium Ammonium Disulphates. Marcel Delépine (*Compt. rend.*, 1909, **148**, 557—560. Compare Abstr., 1906, ii, 551).—When ammonium iridochloride is boiled with moderately concentrated sulphuric acid, a yellow powder is obtained, which dissolves slowly in the acid, giving a green solution. If the solution is mixed with an equal weight of water and left in the cold for some days, a mixture of star-shaped crystals and of rectangular needles separates out.

The dark green, star-shaped crystals correspond with the formula $NH_4{\cdot}H_3[Ir{\cdot}OH(H_2O)(SO_4)_2]_2$. In aqueous solution, this is transformed into the compound $(NH_4)_3H[Ir{\cdot}OH(H_2O)(SO_4)_2]_2$, which crystallises in dark green needles, soluble in 210 parts of water at 16°. This salt is also obtained by adding a solution of the more acid salt to a solution of ammonium chloride or sulphate.

If excess of ammonia is added to the green solution, the colour changes to reddish-brown, and, on the addition of alcohol, an olive-brown substance, corresponding with the formula

$$(NH_4)_7H_2[Ir(OH)_2(SO_4)_2]_3,$$

is precipitated. An aqueous solution of this substance, when acidified, exhibits a green colour, and gives no precipitate with barium chloride.

When heated at 100°, the substance loses one-seventh of its ammonia, and the colour changes from olive-brown to grass-green. The formulæ of these complex salts can be adapted either to the notation of Werner or that of Blomstrand-Jörgensen. H. M. D.

Mineralogical Chemistry.

The Borderland between Colloidal Chemistry, Mineralogy, and Geology. Cornelio Doelter and Felix Cornu (*Zeitsch. Chem. Ind. Kolloide*, 1909, **4**, 189—190).—A series of brief notes on the genesis and synthesis of colloidal magnesite, on the phenomenon of shrinkage in minerals, on the analogy between mineral hydrogels and the organic colloids, and on natural colloidal molybdenum sulphide (jordisite).

Magnesite results from the weathering of serpentine or peridotite in presence of opal, gymnite, picrolite, and dermatine.

The mother substance of ilsemannite is jordisite. H. M. D.

Colloidal Colouring Matters in the Mineral Kingdom. Cornelio Doelter (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 188—189).—The same substance may impart different colours to a mineral according as it is present in the crystalline or colloidal form. The minerals, which are coloured by isomorphous admixture, are changed very little in comparison with the minerals which owe their colour to the presence of colloids when heated or subjected to the action of various gases, radium, or ultra-violet rays. The colour of ruby, emerald, tourmaline, and aquamarine is due to a crystalline admixture; that of citrine, smoky topaz, rose quartz, fluorspar, topaz, and most sapphires is probably due to a colloidal colouring constituent. In certain minerals, colouring substances of both kinds are present, and since the colloidal colouring matter is much less stable than the other, changes in the colour of the mineral can be easily effected.

An experiment is described in which the author covered a plate of smoky quartz with a layer of gold, and then placed it between 220 volt-terminals at a temperature of 900—1000°. The quartz plate was found to have acquired a rose-red colour, due to the presence of colloidal gold particles. H. M. D.

Hatchettite from Bonarka, near Cracow. Józef Morozewicz (*Bull. Acad. Sci. Cracow*, 1908, 1067—1072).—The material forms small nests in Cretaceous marl; it is pearl-white with a tinge of yellow, and has a lamellar structure. Hardness 1; D 0·961. There is a perfect cleavage parallel to the surface of the lamellæ, and the material is brittle. The optical characters point to orthorhombic symmetry, the acute, positive bisectrix being perpendicular to the cleavage. Analysis gave C 85·25, H 14·59%. No bromine is taken up, so that the compound is saturated and belongs to the paraffin series. From the m. p. of 79·4°, the formula $C_{38}H_{78}$ is deduced. The molecular weight, determined in benzene, is about 554, which would correspond with 39 atoms of carbon.

The dark brown ozocerite of Boryslaw, with m. p. 70—83°, was examined, and is, no doubt, a mixture of hatchettite with other hydrocarbons. L. J. S.

Hydrogels of the Mineral Kingdom in the Groups of the Elements, Sulphides and Halides. Felix Cornu (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 187—188. Compare this vol., ii, 222).—According to the author, carbon (as anthracite), sulphur, gold, and silver, and the sulphides of silver, cadmium, mercury, copper, arsenic, and antimony, occur in nature in the form of hydrogels. So-called "buttermilk silver" represents the hydrogel form of silver chloride, and the name *Ostwaldite* is suggested for this mineral. H. M. D.

Regular Intergrowth of Carnallite and Hæmatite. ARRIEN JOHNSEN (*Centr. Min.*, 1909, 168—173).—Carnallite crystals from Stassfurt are colourless to dark red with a metallic schiller, the red colour and schiller being due to the inclusion of minute scales of hæmatite (0·55%). The scales of hæmatite are arranged with the basal plane parallel to the basal plane of the pseudo-hexagonal carnallite, or occasionally parallel to the faces of the form {130}. The origin of the hæmatite is discussed; it is unlikely that the scales were caught up and enclosed in parallel position by the growing crystals of carnallite, and owing to their wide difference in solubility they could not have been both deposited together. The suggestion is made that the iron was originally present in the carnallite as ferrous chloride isomorphously replacing magnesium chloride, and that this by a series of changes (for which equations are given) gave rise to secondary hæmatite.
L. J. S.

Two New Magnesite Occurrences in Carinthia. KARL A. REDLICH (*Zeitsch. prakt. Geol.*, 1908, 16, 456—458).—On account of its economic value, magnesite is much sought for in the Eastern Alps. The two new localities now recorded in Carinthia are the Millstätter Alpe and St. Oswald. At the latter, the mineral has the same mode of occurrence and the same composition as that of Veitsch, in Styria (compare following abstract).

MgO.	CaO.	Fe_2O_3.	Mn_3O_4.	SiO_2.	Al_2O_3.	CO_2.
40·66	2·00	9·81	1·80	1·60	0·15	43·98
39·65	1·60	11·56	0·40	1·44	0·30	45·05

L. J. S.

Minerals of the Magnesite Deposits of Veitsch, Styria. FELIX CORNU (*Zeitsch. prakt. Geol.*, 1908, 16, 449—456).—These magnesite deposits have been formed by the action of solutions of magnesium hydrogen carbonate on the limestones of the Palæozoic sediments. The primary minerals include magnesite, dolomite, pyrites, and talc, and amongst secondary minerals are quartz, dolomite, ankerite, aragonite, calcite, rumphite, pilolite, pyrolusite, and pyrites. The magnesite is also traversed by metalliferous veins containing quartz, copper-pyrites, fahlore, and pyrites, and the alteration of these primary vein minerals has given rise to several other secondary minerals. The magnesite forms coarsely-crystalline masses of a white to yellowish-white colour. The following analyses prove it to be the ferriferous variety, breunnerite.

$MgCO_3$.*	CaO.	Fe_2O_3.	Mn_3O_4.	SiO_2.	Al_2O_3.	$CO_2 + H_2O$.
87·56	1·76	9·96	0·62	1·34	0·76	49·86
90·07	1·33	8·60	0·72	1·28	0·00	50·60
89·86	2·89	8·15	0·76	0·26	0·08	50·87
88·08	0·96	8·74	0·70	0·75	0·95	50·30
85·53	3·52	7·43	0·51	0·79	2·22	50·48

* In original, given as MgO.

L. J. S.

Turanite and Alaite, Two New Vanadium Minerals. K. A. NENADKEVITSCH (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 185—186).—In the uranium and vanadium mines close to the Alai Mountains and south of Andijan, Siberia, the author has found the following new vanadium minerals: (1) *Turanite*, which is a copper vanadate, $V_2O_5,5CuO,2H_2O$, and occurs in compact or spongy form, or as radio-spheroidal aggregates. (2) *Alaite*, which is a hydrated vanadium pentoxide, V_2O_5,H_2O, and occurs in thick, soft, mossy masses having a blood-red colour and a silky lustre. T. H. P.

Alum from Mormugao, India. LEWIS LEIGH FERMOR (*Rec. Geol. Surv. India*, 1908, 36, 312—314).—The mineral occurs as a snow-white efflorescence on the surface of a decomposed argillaceous rock exposed in a cliff section. It owes its origin to the weathering of iron-pyrites contained in the rock. Analysis proves the material to be kalinite, or potash-alum.

K_2O.	Al_2O_3.	SO_3.	H_2O.	Insol.	Total.
7·69	9·74	36·04	46·23	0·30	100·00

L. J. S.

Chemical Investigation of a Caucasian Pyrochlore. G. P. TSCHERNIK (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 365—370).—The sample of Caucasian pyrochlore examined by the author occurred in octahedral crystals, D^{17} 4·308, hardness 5, and had the percentage composition:

Cb_2O_5 (and Ta_2O_5).	TiO_2.	Y_2O_3 (and Ce_2O_3).	CaO.	FeO (and MnO).	MgO.	Na_2O (and K_2O).	F.	SnO_2.	SiO_2.	Total (less O = F).
64·75	3·73	5·56	10·55	6·73	0·92	5·90	1·78	trace	trace	99·17

These results correspond very nearly with the expression:

$$Y_2O_3,Cb_2O_5 + 2(2CaO,Cb_2O_5) + 2Ca(CbO_3)_2 + 4Fe(CbO_3)_2 + Mg(CbO_3)_2 + 2(CaO,TiO_2) + 4NaF.$$

T. H. P.

Formation of Nontronite by the Action of Solutions of Iron Sulphate on Wollastonite. ALFRED BERGEAT (*Centr. Min.*, 1909, 161—168).—Nontronite occurs abundantly as a mineral of recent formation in the levels of the copper mines at Aranzazú, near Concepción del Oro in Mexico. The veins of copper-pyrites are associated with wollastonite, garnet, and other contact minerals at the contact of limestone with granodiorite. The wollastonite is usually much altered; the freshest material (anal. I) is flesh-red with a fibrous to columnar structure; it is often altered to yellowish-green nontronite, and pseudomorphs of nontronite after wollastonite were found. Anal. II is of the nontronite, purified by washing the powdered material in water and separating with a heavy liquid; this material (dried at 110°) still contained some limonite, garnet, and magnesium silicate, but probably no opal, and the composition calculated for the pure material is given under III, agreeing with the formula $H_8Fe_4Si_9O_{28}$ (compare Abstr., 1897, ii, 413).

	SiO_2.	Al_2O_3.	Fe_2O_3.	MnO.	CaO.	MgO.	H_2O.	Total.	Sp. gr.
I.*	46·71	0·69	—	2·62	34·25	0·85	4·66	95·76	2·88
II.	57·64	4·09	26·14	—	2·27	1·90	6·90	98·94	2·29
III.	59·40	3·08	29·68	—	—	—	7·84	100·00	—

* Also FeO, trace; K_2O, 0·08; Na_2O, 0·18; SO_3, 1·15; CO_2, 4·57.

The alteration of the copper-pyrites has given rise first to bornite and then to copper-glance, whilst the iron it contains passed into solution as sulphate, which acted on the wollastonite with the formation of nontronite. Wollastonite when placed in a solution of ferrous sulphate causes the precipitation of iron hydroxide, and some calcium passes into solution. L. J. S.

Cæsium in Felspar. Wladimir I. Vernadsky (*Bull. Acad. Sci. St. Pêtersbourg*, 1909, 163—164).—Orthoclases from Murzinki and Shajtanki contain, besides lithium, rubidium and cæsium in quantities sufficient to allow of their separation as platinichlorides, whilst some of those from Murzinki show the presence of thallium when examined spectroscopically. The presence of rubidium is seen clearly, and that of cæsium less clearly, in the spectrum of microcline from the Ilmen Mountains. T. H. P.

Jadeite in the Kachin Hills, Upper Burma. Alfred William Gustav Bleeck (*Rec. Geol. Surv. India*, 1908, 36, 254—285).—A description is given of the jadeite mines and of the geology of the district. At Tawmaw the jadeite occurs with albite in an igneous dyke traversing serpentine. It is suggested that the rock of this dyke was originally a nepheline-albite-rock, which has been altered by dynamometamorphism, the change $NaAlSiO_4$ (nepheline) + $NaAlSi_3O_8$ (albite) = $2NaAlSi_2O_6$ (jadeite) being accompanied by a diminution in volume. The albite has sometimes precisely the appearance of jadeite, being pure white to light grey with pale green spots, translucent, and compact, with a splintery fracture; such material ("pseudojadeite") was proved by analysis I to be albite. Fragments of a dark green (emerald-green in thin sections) mineral, containing a few small crystals of chromite, are also abundant in the Tawmaw quarry; they have the optical characters of epidote, and gave analysis II; for this chromiferous epidote, the name *tawmawite* is proposed.

	SiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.	Sp. gr.
I.	67·10	20·42	—	0·23	—	8·93	3·20	—	99·80	2·577
II.	37·92	12·83	11·16	9·93	25·35	—	—	2·38	99·57	

At the neighbouring localities of Hwéka and Mamon the jadeite is quarried in a conglomerate and in alluvial deposits. L. J. S.

Physiological Chemistry.

Physico-chemical Relations of Red-blood Corpuscles. IVAR BANG (*Biochem. Zeitsch.*, 1909, 16, 255—276).—A repetition, correction, and extension of the older observations of others, chiefly as regards agglutination and the permeability of red-blood corpuscles. The erythrocytes of the calf are not agglutinated by treatment with sugar solution, but those of the ox are. This apparent discrepancy is due to the different method of bleeding, the calf's blood being arterial and containing less carbon dioxide. If the carbon dioxide in ox blood is first washed away, ox corpuscles are no longer agglutinated in sugar solution. Ox corpuscles have a fairly considerable permeability to salts. The rate of diffusion of carbon dioxide is, however, much greater, and must be taken into account when considering the isotonic coefficient of the blood. When blood is diluted with sodium chloride solution, the variable quantity of carbon dioxide in the erythrocytes is partly replaced by hydrochloric acid, making the isotonic coefficient somewhat variable and indeterminate. G. B.

Metabolism in the Infant. WALTHER FREUND (*Biochem. Zeitsch.*, 1909, 16, 453—472).—A number of observations on infants are recorded, the chief points examined being the amount of fat and soaps in the fæces during different diets. Some details regarding calcium metabolism are also given. No general conclusions are drawn.
W. D. H.

Protein Metabolism. EMIL ABDERHALDEN (*Zeitsch. physiol. Chem.*, 1909, 59, 177—193).—A discussion of Voit's well-known theory of the difference between "organ protein" and "circulating protein." The comparatively high output of urinary nitrogen during the first few days of starvation is attributed by the theory to the breakdown of the "circulating protein." It is pointed out that it is a pure assumption that the source of this extra nitrogenous waste is protein. It may be mere worthless ballast in non-protein form which is broken up and excreted. Some experiments on dogs are recorded at length, which show that the course of nitrogenous excretion during inanition is much the same, whether the animal had been previously fed on excess of protein food or not. W. D. H.

Rôle of the Ash Constituents of Wheat Bran in the Metabolism of Herbivora. EDWIN B. HART, ELMER V. MCCOLLUM, and G. C. HUMPREY (*Amer. J. Physiol.*, 1909, 24, 86—103).—Details are given of the relative amounts of potassium, magnesium, etc., in fæces and urine in accordance with differences in the intake. Magnesium, when supplied as a chloride or phytin compound, was largely excreted in the gut. Variations in the intake of various ash constituents or of phytin did not influence the composition of the milk. Phytin causes diuresis, probably because of the high potassium intake. Absence of phytin leads to constipation. W. D. H.

Influence of Alcohol on Metabolism in Animals during Inanition. Martin Kochmann and Walter Hall (*Pflüger's Archiv*, 1909, 127, 280—356).—In moderate doses, subcutaneous administration of alcohol in rabbits during inanition increases the period during which they live, but large doses hasten death. The favouring action is due to protein sparing, and to the retention of water. Death is accelerated by large doses owing to increase of protein catabolism, especially of proteins poor in sulphur, as evidenced by the N : S ratio. Alcohol produces a diuretic action only when given in large doses.

W. D. H.

Protein Absorption. Otto Cohnheim (*Zeitsch. physiol. Chem.*, 1909, 59, 239—246).—Experiments on fishes are recorded into the intestine of which protein cleavage products were introduced. These are partly absorbed as ammonia, partly deamidised during absorption, and the remainder are absorbed in an unknown way. W. D. H.

Peptolytic Enzymes in the Stomach. II. Emil Abderhalden and Alfred Schittenhelm (*Zeitsch. physiol. Chem.*, 1909, 59, 230—232. Compare Abstr., 1908, ii, 1049).—Glycyl-*l*-tyrosine, or peptone from silk, which is rich in tyrosine, may be employed for the detection of peptolytic enzymes. They are absent from pure gastric juice, and when present in the stomach are due to regurgitation from the intestine, which may be increased by the administration of oil. Their presence may be employed for diagnosis of such regurgitation in disease. W. D. H.

Chemical Mechanism of Gastric Secretion. J. Sydney Edkins and M. Tweedy (*J. Physiol.*, 1909, 38, 263—267).—By a specially devised method, the fundus and pyloric ends of the stomach in cats were functionally separated. Different substances were placed in the pyloric end or in the duodenum; the fundus responded by a marked secretion, although the same substances placed in the fundus itself provoked none. The effectiveness of the substances used was in the following order: meat extracts, dextrose, dextrin, and least of all hydrochloric acid. W. D. H.

Action of Certain Hitherto Unknown Constituents of the Pancreas on Sugar. I. Ernst Vahlen (*Zeitsch. physiol. Chem.*, 1909, 59, 194—222).—The theory propounded is that the cleavage of sugar is the result of the catalytic action of certain substances formed in the pancreas. In support of this, certain substances are stated to have been separated from the pancreas, one of which produces a breakdown of sugar and evolution of carbon dioxide, and also favours alcoholic fermentation, whilst another produces the opposite results. No details are given either of the mode of preparation or chemical nature of the substances in question.

W. D. H.

Action of Secretin and Receptive Substances. Walter E. Dixon and P. Hamill (*J. Physiol.*, 1909, 38, 314—336).—Enzymes exist in the pancreas as precursors: protrypsinogen, proamylopsin, and prosteapsin. Secretin combines chemically with these and liberates the active enzyme in the two last cases, but only liberates trypsinogen in the first, which in its turn is converted into trypsin by the entero-kinase of the succus entericus.

No evidence that vegetable alkaloids exert a specific effect in the body by combining with "receptive substances" was obtained; but it is suggested that the physiological activity of muscle and gland is due in all cases to the liberation of specific hormones, which combine with "receptive substances."

The statement that secretin and choline are identical is criticised.

W. D. H.

The Rôle of the Small Intestine in the Formation of Glycogen from Dextrose. Karl Grube (*Pflüger's Archiv*, 1909, 127, 529—532).—Croftan (this vol., ii, 328) has stated that the small intestine produces some preliminary condensation of sugar molecules, without which the liver is unable to make glycogen from dextrose. The present experiments show that the injection of dextrose into a mesenteric vein leads to glycogen formation in the liver.

W. D. H.

A Mucoid in the Intestinal Mucous Membrane of the Horse. Hubert W. Bywaters (*Proc. physiol. Soc.*, 1909, xlii—xliii; *J. Physiol.*, 38).—About 20 grams of a mucoid, believed to be identical with sero-mucoid, were separated from 20 kilos. of moist mucous membrane. It contains from 5·68 to 7·91% of ash. W. D. H.

Transformations in the Phosphorised Compounds of the Hen's Egg during Development. R. H. Aders Plimmer and Frederick H. Scott (*J. Physiol.*, 1909, 38, 247—253).—The following table gives the distribution of phosphorus in (1) the unincubated egg, and in (2) the newly-hatched chick:

	(1.)	(2.)	
Inorganic phosphate	trace	60·0	per cent. of total
Water soluble organic compounds	6·2	8·6	,, ,,
Ether soluble substances	64·8	19·3	,, ,,
Nuclein-like substances	1·9	12·0	,, ,,
Vitellin	27·1	0·0	,, ,,

Ether soluble and other organic compounds must therefore have been transformed into inorganic phosphates; this change begins markedly about the sixteenth or seventeenth day of incubation. Glycero-phosphoric acid is believed to give rise to inorganic phosphates only. There is also a probable transformation of the phospho-protein (vitellin) into nucleo-protein as well as into inorganic phosphate.

W. D. H.

Fatty Infiltration of the Liver in Hunger. V. H. Mottram (*J. Physiol.*, 1909, 38, 281—313).—After twenty-four hours' inanition in rabbits and guinea-pigs (but not in hedgehogs, pigeons, or rats), the percentage of fat in the liver increases; this is sometimes due to the shrinkage of the liver, but in other cases, especially in rabbits, is produced by a migration of fat into the liver from other parts, and in the process the fat undergoes a change in the direction of desaturation.

W. D. H.

Desaturation of Fatty Acids in the Liver. John B. Leathes and L. Meyer-Wedell (*Proc. physiol. Soc.*, 1909, xxxviii—xl; *J. Physiol.*, 38).—By feeding rats on various fats, it is shown that the liver as well as the connective tissue takes up fats conveyed to it by the blood. Other organs do not do the same to any extent. The connective (adipose) tissue stores the fat as brought to it; the liver, however, changes it so as to increase its power of absorbing iodine. This furnishes additional evidence in support of the view that one function of the liver is to prepare fat for oxidation in other tissues, and that the preparatory treatment consists, in part, of a desaturation process. W. D. H.

The Behaviour of the Liver to Foreign Proteins. Felix Reach (*Biochem. Zeitsch.*, 1909, 16, 357—363).—Iodoprotein perfused through the liver was taken up by that organ. A cleavage of the protein was only recognisable in small measure. W. D. H.

Liver Ferments, with Special Reference to the Gelatinolytic Enzyme. S. Hata (*Biochem. Zeitsch.*, 1909, 16, 383—390).—This is a contribution to the subject of intracellular enzymes in the liver, and deals especially with the details of action (time, quantity, etc.) of liver extracts in liquefying gelatin. W. D. H.

Pressor Substances in Placental Extracts. Otto Rosenheim (*J. Physiol.*, 1909, 38, 337—342).—The pressor substances which are obtainable from human placenta are products of initial putrefaction; the autolytic enzymes without the aid of micro-organisms are unable to produce them, that is, they are unable to split off the terminal carboxyl group of the amino-acids. The most active substance separated out was identified as *p*-hydroxyphenylethylamine; the identity of another with *iso*amylamine is probable. The bases are identical with those found by Barger and Walpole in putrid meat (see next abstract). W. D. H.

Pressor Substances in Putrid Meat. George Barger and George S. Walpole (*J. Physiol.*, 1909, 38, 343—352. Compare this vol., ii, 254).—In the putrefaction of horse-flesh, bases are formed which cause a rise of arterial blood-pressure when injected intravenously; they are derived from amino-acids by the loss of carbon dioxide. The following were isolated: *iso*amylamine (from leucine), *p*-hydroxyphenylethylamine (from tyrosine), and probably phenylethylamine (from phenylalanine). The second is the most powerful. The pressor base previously obtained from putrid meat by Abelous and his colleagues is probably *iso*amylamine. W. D. H.

Lipoids of the Adrenal. Otto Rosenheim and M. Christine Tebb (*Proc. physiol. Chem.*, 1909, liv—lvi; *J., Physiol.*, 38).—The anisotropic substance of the adrenal cortex is not, as Powell White suggests, a mixture of cholesterol and fatty acids, although such a mixture readily produces anisotropic globules. Free cholesterol is absent, but cholesterol esters (palmitic and stearic) as well as free stearic and other fatty acids are present. In the brain and other organs, cholesterol exists in a free state. A small quantity of sphingomyelin was also separated.

Whether the function of the adrenal cortex is the neutralisation of toxins is a subject to be pursued. The present analyses tend to support this view. W. D. H.

The Human Pituitary. William D. Halliburton, J. P. Candler, and A. W. Sikes (*Proc. physiol. Soc.*, 1909, xxxvii; *J. Physiol.*, 38).—The human pituitary weighs about 0·5 gram, and contains 76% of water. A single pituitary will, however, make sufficiently strong extracts to test their physiological action. Extracts of the anterior lobe are inactive or produce an insignificant fall of blood-pressure, such as is caused by tissue extracts generally. Extracts of the posterior lobe produce, as was found by Schäfer and his colleagues in their work on the pituitary of other mammals, (1) a rise of arterial pressure at the first injection, (2) a constriction of peripheral vessels, but (3) prolonged dilatation of the kidney vessels, accompanied by (4) diuresis. The pituitaries used came from asylum cases, but in nearly all cases the structure was normal. The number and size of the colloid cysts vary a good deal, but the colloid material does not appear to be the substance to which the extracts owe their activity. In man and ox, the pituitary contains no iodine.

W. D. H.

Heat Coagulation in Smooth Muscle. The Connexion between Protein Coagulation and Heat Rigor. Edward B. Meigs (*Amer. J. Physiol.*, 1909, 24, 1—13, 178—186. Compare this vol., ii, 251).—Lactic acid formation is an accompaniment of heat coagulation in smooth muscle; this is believed to cause the fibre cells to swell in such a way that they lengthen.

The view is advanced that the heat shortening of tissues is not due to coagulation of their protein constituents, but to some other process, the nature of which is left vague. W. D. H.

Hydrolysis of Muscle of Scallop (Pectens viradians). Thomas B. Osborne and D. Breese Jones (*Amer. J. Physiol.*, 1909, 24, 161—169).—The amounts of amino-acids obtained are not vastly different from those previously given for the muscle of halibut and chicken. Glycine is absent in the muscle of halibut and scallop, but present in small amount in chicken's muscle. Ox muscle, on the other hand, yields a larger amount. The scallop contains relatively a good deal of free glycine. W. D. H.

Chemico-physical Investigations on the Crystalline Lens. Filippo Bottazzi and Noè Scalinci (*Atti. R. Accad. Lincei*, 1909, [v], 18, i, 225—228. Compare this vol., ii, 162).—Lenses of dogs' eyes, immersed in aqueous or vitreous humour, were found in one case, first to diminish and then increase, and in another, first to increase and then diminish in weight. The diminution in weight may be explained as due to the diffusion outwards of the protein substances of the lens surpassing the penetration of liquid into the lens. The increase of weight can only be the effect of an increase in the degree of imbibition of the lens in consequence of a diminution of the elasticity of the capsule. In all the experiments, the body of the lens remained quite transparent, not only when the uninjured capsule limited the imbibition, but even for nineteen hours after the capsule had been removed. Hence a much longer period is necessary for the increase of the degree of imbibition of the crystalline lens, immersed in normal ocular liquids, to produced opacity of the lens.

T. H. P.

The Influence of Electrolytes on the Rhythmical Movements of Medusæ. II. ALBRECHT BETHE (*Pflüger's Archiv*, 1909, 127, 219—273. Compare Abstr., 1908, ii, 969).—Medusæ continue to live and move in artificial mixtures of salts provided they are present in the same proportions as in sea-water.

Sodium chloride alone hastens, then paralyses their movements; this action is reversible; potassium chloride stimulates in large doses; calcium chloride strengthens the systole, and in large doses lessens its frequency, and finally stops it, producing inexcitability. Magnesium chloride and sulphate have primary paralysing action; aluminium has the same action, only more markedly. The accelerating action of sodium salts is as follows: $Na_2SO_4 > NaCl > NaI > NaBr > NaNO_3$, and the potassium salts: $K_2SO_4 > KCl > KNO_3$; the paralysing action of magnesium sulphate is greater than that of the chloride. Increase of hydrogen ions stimulates, of hydroxyl ions, paralyses. The membrane of the medusæ is probably not permeable to hydrogen and hydroxyl ions.

W. D. H.

Formation of Silk. EMIL ABDERHALDEN and H. R. DEAN. EMIL ABDERHALDEN and WOLFGANG WEICHARDT (*Zeitsch. physiol. Chem.*, 1909, 59, 170—173, 174—176).—Silk contains much tyrosine, glycine, and alanine. On the view that these acids are present in the silk-worm in abundance, the mono-amino-acids were estimated in the body of the silk-worm and in the moth after silk formation, with the following results.

	In silk-worm.	In moth.
Glycine	10·2 %	3·5 %
Alanine	8·7	3·2
Valine	1·7	1·7
Leucine	4·8	8·5
Aspartic acid	1·6	2·7
Glutamic acid	3·5	5·7
Phenylalanine	2·4	2·7
Tyrosine	4·3	1·6
Proline	1·5	1·0

In the first column the high percentage of glycine, alanine, and tyrosine is noteworthy, so also is the fall in each in the second column.

W. D. H.

Connexion between Changes of Permeability and Stimulation. RALPH S. LILLIE (*Amer. J. Physiol.*, 1909, 24, 14—44).—A number of experiments are given on the influence of salts on the contraction of *Arenicola* larvæ. Solutions which produce contraction, and these only, produce a diffusion outwards of a yellow pigment in the larvæ; stimulating agents increase the normal permeability; their effect is considered to depend essentially on their influence in varying the rate at which carbon dioxide leaves the cell. W. D. H.

Sugar Formation in Pupæ. OTTO KRUMMACHER and ERNST WEINLAND (*Zeitsch. Biol.*, 1909, 52, 273—279).—The experiments were performed with the pupæ of *Calliphora*. Calorimetric observations are recorded, and the general conclusion is drawn that sugar is formed from protein and not from fat. W. D. H.

Physiology of Mollusca. IV. Purine Substance of Sycotypus. LAFAYETTE B. MENDEL and H. GIDEON WELLS (*Amer. J. Physiol.*, 1909, 24, 170—177).—The purine bases obtained by acid hydrolysis of the liver of the gasteropod, *Sycotypus canaliculatus*, are the same as those derived from the comparable tissues of the higher animals, namely, adenine, guanine, hypoxanthine, and xanthine. The amino-purines preponderate; hence it is probable that the nucleo-protein complexes are much the same in molluscs as in vertebrates. Nuclease, adenase, and guanase are present in the molluscan liver; xantho-oxydase, the uricolytic enzyme, and uric acid were not found. W. D. H.

Chemical Processes in Worms. II. ERNST J. LESSER (*Zeitsch. Biol.*, 1909, 52, 282—297. Compare Abstr.. 1908, ii, 309).—In anoxybiosis the chief product formed by the earth worm is volatile fatty acid, probably a valeric acid. During the process, the alcoholic fermentation of sugar does not occur. The parent substance of the fatty acid is probably carbohydrate (glycogen). In the first eight days of inanition, during six hours anoxybiosis, 1 molecule of fatty acid is formed per 3 molecules of carbon dioxide. W. D. H.

Creatinine Output in Man. PHŒBUS A. LEVENE and L. KRISTELLER (*Amer. J. Physiol.*, 1909, 24, 45—65).—In pathological conditions of the muscular system, the rate of catabolism of ingested creatine is lowered, and part of the creatine is removed in the form of creatinine. In some forms of muscular disease, the creatinine output is normal, in others it is altered; in others, ingestion of meat increases the output of both creatine and creatinine.

These facts are considered inexplicable by any of the current theories, and two factors are stated to be of importance: (1) the formation of creatinine, and (2) its further oxidation; disturbances of either factor will lead to an abnormal creatinine output. W. D. H.

Hypno-anæsthetics. A. BRISSEMORET and J. CHEVALIER (*Compt. rend.*, 1909, 148, 731—733).—A description of the physiological action of ββ-dichloropropane and ββ-diethoxypropane.

The experiments, which were carried out on dogs by intraperitoneal injection, show that the hypno-anæsthetic properties of the former compound are not sufficiently well marked to render it of practical value. In its pharmacodynamic action ββ-diethoxypropane resembles the acetals already studied. The accelerating influence it exerts on the heart restricts its field of useful application. W. O. W.

The Effect on the Animal Organism of Chloroform and Cocaine or Strychnine. Joh. Dogiel (*Pflüger's Archiv*, 1909, **127**, 357—442).—A large number of experiments on the effect of chloroform on the heart, pulse, and circulation generally, on the respiration, nervous system, reflexes, etc., are recorded. The cessation of respiration so often observed in the preliminary induction of chloroform anæsthesia is attributed to a reflex action from the respiratory passages and lungs. In many points cocaine, like strychnine, acts antagonistically to chloroform, and the main outcome of the research is a recommendation to employ cocaine with chloroform, in order to lessen the danger of the latter. W. D. H.

[Physiological Action of Optical] Isomerides of Adrenaline. Arthur R. Cushny (*J. Physiol.*, 1909, **38**, 259—262. Compare Abstr., 1908, ii, 720).—The minimal lethal dose of *l*-adrenaline in rats is 1—2 mg. per 100 grams of body-weight; that of *d*-adrenaline is 12 to 15 more. The same relationship in activity is seen in the effects on blood-pressure and in producing glycosuria. No evidence was obtained suggesting that adrenaline acts elsewhere than on the "receptive substances" of the sympathetic myo-neural junction. W. D. H.

Physiological Action of *l*-, *d*-, and *dl*-Adrenalines. III. Emil Abderhalden and Slavu (*Zeitsch. physiol. Chem.*, 1909, **59**, 129—137. Compare this vol., ii, 333; also Cushny, preceding abstract).—The present experiments confirm the conclusions previously arrived at, that *d*-adrenaline is less active physiologically than *l*-adrenaline; the points specially referred to are: (1) contraction of the pigment cells of the frog's skin; (2) lowering of body temperature, and (3) fatal dose.

W. D. H.

Glycine as a Detoxicating Agent. Henry D. Dakin (*J. Biol. Chem.*, 1909, **5**, 413—418).—When benzoic acid is introduced into the body, it is promptly converted into hippuric acid and excreted. It is not clear whether this union with glycine is protective, as the toxic action of benzoic acid is not known.

The glycine compounds of phenylpropionic acid, cinnamic acid, and β-hydroxyphenylpropionic acid are non-toxic, but the acids themselves are poisonous. The glycine compounds are much more resistant to oxidation than the acids. W. D. H.

Behaviour of Atoxyl in the Organism. J. Igersheimer and A. Rothmann (*Zeitsch. physiol. Chem.*, 1909, **59**, 256—280. Compare Abstr., 1908, ii, 1061).—The undecomposed atoxyl in the circulating blood appears to have a strong action on cells (trypanosomes or tissue cells), with the formation of toxic products; this is not certain, but what is regarded as certain is that the toxic action of atoxyl is determined by two factors: (1) the formation of a reduction product, and (2) the liberation of arsenic in inorganic combination.

W. D. H.

Chemo-therapeutic Experiments with Some New Atoxyl Preparations in Spirochaete Diseases, with Special Reference to Experimental Syphilis. PAUL UHLENHUTH and MANTEUFEL (*Chem. Zentr.*, 1909, i, 782; from *Zeitsch. Immunitätsforsch. exp. Therap.*, 1908, 1, 108—132. Compare also following abstract).—The acid mercuric salt of *p*-aminophenylarsinic acid (of which atoxyl is the sodium salt) works better than atoxyl derivatives containing iodine, which are more toxic than atoxyl. Mercuric iodophenylarsinate is less toxic than the corresponding sodium salt. The action of arsenophenylglycine has also been examined. G. B.

Constitution and Toxicity of Various Substances of the Atoxyl Group. FERDINAND BLUMENTHAL (*Chem. Zentr.*, 1909, i, 782; from *Med. Klin.*, 1908, Heft 44, 2 pp.).—Although acetylatoxyl is much less poisonous than atoxyl, the same does not hold for the corresponding mercury salts. *p*-Iodophenylarsinic acid is more toxic than atoxyl, but the mercury salt of the former acid is less toxic than the mercury salt corresponding with atoxyl (compare preceding abstract). The cause of this change in toxicity is not due to greater difficulty of absorption, for most of the iodine appears in the urine within twenty-four hours. G. B.

The Detection and the Course of Excretion of Atoxyl in Urine. Observations on the Paper by Lockemann and Paucke. FERDINAND BLUMENTHAL (*Chem. Zentr.*, 1909, i, 949; from *Deutsch. med. Woch.*, 1908, 34, No. 52).—Polemical against Lockemann and Paucke (this vol., ii, 167). The precipitate obtained by these authors with β-naphthylamine in the diazotised urine of patients after treatment with atoxyl consisted only to a small extent of an atoxyl-dye; over 80% was impurity. The author does not agree with Lockemann and Paucke's conclusion, that arsenious oxide is set free, and maintains his position as regards the duration of arsenic excretion after the administration of atoxyl. G. B.

The Excretion of Atoxyl through the Urine. Reply to the Observation of F. Blumenthal. GEORG LOCKEMANN (*Chem. Zentr.*, 1909, i, 949; from *Deutsch. med. Woch.*, 1909, 35, No. 5).—Reply to Blumenthal (compare preceding abstract), and criticism of his gravimetric arsenic estimation. G. B.

Acapnia and Shock. III. YANDELL HENDERSON (*Amer. J. Physiol.*, 1909, 24, 66—85).—A further development of the author's views with special reference to abdominal operations. Local acapnia, due to direct exhalation of carbon dioxide, is a factor in the loss of tonus of exposed viscera. Carbon dioxide tension in the nerve centres and in the tissues and fluids of the body is a factor in the maintenance of tonus. Restoration of the body's store of carbon dioxide is effective as a method of relief. W. D. H.

Protein Metabolism in Carbon Monoxide Poisoning. CHARLES G. L. WOLF and EMIL OSTERBERG (*Biochem. Zeitsch.*, 1909, 16, 476—485).—Experiments on dogs are recorded with very complete urinary analyses, especially in relation to nitrogen and sulphur. The most remarkable feature in some cases as the result of poisoning by carbon monoxide is the excretion of creatine in amounts exceeding that found in inanition. This was not, however, always found.

W. D. H.

Effect of Hydrogen Peroxide on Gonionemus. O. P. TERRY (*Amer. J. Physiol.*, 1909, 24, 117—123).—The rhythmical contractions of the bell of the jelly-fish gonionemus cease when the margin of the bell containing the nerves is removed. Hydrogen peroxide will initiate pulsations in the marginless bell in normal sea-water by increase of oxidation processes. W. D. H.

Mineral Constituents of Bone in Osteomalacia. CÆSARE CAPPEZZUOLI (*Biochem. Zeitsch.*, 1909, 16, 355—356).—In this disease, the percentage quantity of ash is lessened; the diminution of calcium is greater than that of magnesium. The alterations are more marked in flat than in long bones. W. D. H.

The Diastatic Enzyme of Paramœcium in Relation to the Killing Concentration of Copper Sulphate. AMOS W. PETERS and OPAL BURRES (*J. Biol. Chem.*, 1909, 6, 65—73).—The data given show a uniform correlation between the concentration of copper sulphate required to kill *Paramœcia* instantly and that which markedly inhibits the action of their diastase. This suggests the more general conclusion that the injurious action of certain poisons which act in low concentrations may be due to the inactivation of protoplasmic enzymes. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Bacillus Infantilis. ARTHUR I. KENDALL (*J. Biol. Chem.*, 1909, 5, 419—438); CHRISTIAN A. HERTER and A. I. KENDALL (*ibid.*, 439—442).—This new bacillus is found in certain chronic intestinal infections, and is believed by Herter to be related to what he terms "infantilism," in which, in addition to intestinal troubles, there is an arrest of bodily development and a slight retardation of cerebral development. Large amounts of indican and phenolic substances occur in the urine; indoleacetic and aromatic hydroxy-acids are also often in excess. The bacillus is a powerful alkali producer, ammonia and a primary amine being the chief basic substances found in cultures. It does not produce indole, scatole, or phenolic substances. Whether it produces "infantilism" is left open, but the observations recorded are considered to prove that irritant products produced by its growth may cause diarrhœa. W. D. H.

Constituents of Emmenthal Cheese. IV. ERNST WINTERSTEIN and ALBERT KÜNG (*Zeitsch. physiol. Chem.*, 1909, 59, 138—140. Compare Abstr., 1906, ii, 248).—The present experiments show the occurrence of *p*-hydroxyphenylethylamine in Emmenthal cheese; its presence is attributed to bacterial action. W. D. H.

Oxidation by Fungi. II. REGINALD O. HERZOG and A. MEIER (*Zeitsch. physiol. Chem.*, 1909, 59, 57—62. Compare Abstr., 1908, ii, 1063).—The oxidation by fungi of the two antipodes of hydroxy-acids containing an asymmetric carbon atom takes place with different velocities. It is a ferment action, for the fungus can be killed with alcohol, acetone, etc., or by liquid air. Acids without an asymmetric carbon atom are scarcely attacked. Intermediate products have not as yet been isolated, although the oxidation does not proceed at once to carbon dioxide. G. B.

Specificity of Peptolytic Enzymes in Different Fungi. EMIL ABDERHALDEN and HANS PRINGSHEIM (*Zeitsch. physiol. Chem.*, 1909, 59, 249—255).—A comparison of the action of the enzymes of various moulds in the cleavage of certain polypeptides shows that there are differences of degree and of kind in their actions. W. D. H.

The Function of Septic Tanks in the Biological Purification of Sewage. ACHILLE MÜNTZ and E. LAINÉ (*Compt. rend.*, 1909, **148**, 597—601).—Before passing to the oxidising beds, sewage is generally first placed in deep reservoirs, where it forms a reducing medium, characterised by putrid emanations. The chief use of these reservoirs is to allow suspended matter to settle down; they do not further aid in the oxidation of the organic substances in the sewage. G. B.

The Effect of Ammonium Salts on the Fermentation of Wines. W. BIERBERG (*Centr. Bakt. Par.*, 1909, ii, 23, 12—32).—It is known that yeast can utilise the nitrogen in ammonium salts as food, and the author investigates the effect of adding ammonium salts to wines undergoing fermentation. The most striking result is the influence of the initial content of alcohol. The larger the amount of alcohol present originally the smaller the amount of ammonium salt necessary in order to produce a strong fermentation. Reasons are adduced for supposing that the ammonium salt acts rather as a stimulant than as a nutrient. E. J. R.

The [Carbon] Assimilation Process [in Plants]. HANS EULER (*Zeitsch. physiol. Chem.*, 1909, 59, 122—124).—Oxalic acid is not, as supposed by Baur, an intermediate product in carbon assimilation, but rather an oxidation product of sugar, and due to respiration. The author's experiments support Ewarts', criticism (Abstr., 1908, ii, 217) of Usher and Priestley's conclusion (Abstr., 1906, ii, 299, 881) that formaldehyde is formed from carbon dioxide and a chlorophyll extract in the light. G. B.

Photodynamic Action of Chlorophyll and its Relation to the Photosynthetic Assimilation of Plants. WALTHER HAUSMANN (*Biochem. Zeitsch.*, 1909, 16, 294—312).—Tappeiner (Abstr., 1908, ii, 867) and his pupils have shown that certain fluorescent substances, such as eosin, under the influence of light hæmolyse a suspension of red-blood corpuscles and kill *Paramœcia.* The author now shows that chlorophyll, including the crystallised chlorophyll of Willstätter, has the same effect on both objects. This "photodynamic" action takes place in the same regions of the spectrum as photosynthesis, so that there appears to be an intimate connexion between assimilation and the photodynamic action of chlorophyll. The photodynamic action of phylloporphyrin is identical with that of hæmatoporphyrin. G. B.

The Effect of Light on the Formation of Protein in Plants. W. Zaleski (*Ber. deut. bot. Ges.*, 1909, 27, 56—62).—The fact that plants can form protein in absence of light, provided sugar and nitrates are supplied, indicates that light plays only an indirect part in protein formation; certain physiologists have, however, recently supposed that light acts directly and supplies energy. The author's experiments are entirely opposed to the latter view.

Portions of etiolated bean seedlings were grown on culture solutions containing respectively 5 and 10 per cent. of sugar for five and ten days under aseptic conditions. Some of the experiments were made in ordinary light, others in yellow light (light which has passed through saturated potassium dichromate solution), others in blue light (light passed through 2% cuprammonium hydroxide solution). No difference was observed between yellow and blue light, and protein formation is therefore independent of the wave-length of the light. It is noteworthy, however, that protein formation was more intense in coloured than in white light. E. J. R.

Ammonia as a Decomposition Product of the Nitrogenous Compounds in Higher Plants. Wl. Butkewitsch (*Biochem. Zeitsch.*, 1909, 16, (6), 411—452).—A general discussion, with copious references to the literature of the subject. The production of ammonia goes on even after the protoplasm has been killed; it is, however, bound up with an oxidation process. This observation appears to rule out of court several of the hypotheses which have been advanced to account for the decomposition, and lends support to the view that ammonia is produced by the oxidation of a proteolytic substance. In this connexion Dakin's observation is of interest, that amino-acids on oxidation with hydrogen peroxide give rise to fatty acids, aldehydes, and ammonia:

$$R{\cdot}CH(NH_2){\cdot}CO_2H + O_2 = R{\cdot}CO_2H + NH_3 + CO_2$$
$$R{\cdot}CH(NH_2){\cdot}CO_2H + O = R{\cdot}COH + NH_3 + CO_2,$$

but it is not clear that oxidation is an indispensable condition, and it is possible that even in one and the same cell ammonia may be formed by several different processes, as by oxidation of an amino-acid or by addition of hydrogen to an amide. E. J. R.

Cyanogenetic Plants. Anne W. K. de Jong (*Rec. trav. chim.*, 1909, 28, 24—41).—Treub has shown (Abstr., 1896, ii, 327) that the leaves of *Pangium edule* contain hydrogen cyanide, partly as a stable compound hydrolysed by an enzyme also present in the leaves, and probably also in a free or very loosely combined condition, since a greater or less quantity is evolved when the leaves are treated with boiling absolute alcohol.

The stable compound isolated from the leaves is shown to be identical with the glucoside gynocardin discovered by Power and Lees (Trans., 1905, **87**, 349) in the seeds of *Gynocardia odorata.*

When an absolute alcoholic solution of gynocardin cooled to −10° is treated with sufficient aqueous gynocardase solution to dilute the alcohol to the same extent as that effected by the moisture contained in the leaves of *Pangium edule*, the solution after one hour is found to contain a very small amount of hydrogen cyanide (estimated by adding a known excess of potassium hydroxide solution containing a chloride and titrating with *N*/100-silver nitrate solution, correction being made for the retardation in the appearance of the opalescence by the excess of alkali), but as the quantity remains constant the conclusion is drawn that enzyme action is inhibited by alcohol of such strength at −10°, and that the trace of hydrogen cyanide detected is liberated before the aqueous enzyme solution is completely mixed with the alcoholic glucoside solution. In order, therefore, to determine whether the evolution of hydrogen cyanide when the leaves of *Pangium edule* are treated with boiling alcohol is due to enzyme action, experiments were carried out at −10°. When fragments of the leaves are immersed in absolute ethyl alcohol at −10°, hydrogen cyanide is liberated in amounts almost equal to those evolved by the treatment with boiling alcohol, and 50—100 times as great as that observed in the experiment (above) with alcoholic gynocardin solution. The conclusion is drawn that the hydrogen cyanide extracted from the leaves by alcohol occurs either in a free or very loosely combined condition, possibly as a cyanohydrin. Since Ultée (this vol., i, 293) has shown that the cyanohydrins do not precipitate silver nitrate solution, a series of determinations were made of the amounts of hydrogen cyanide extracted from the leaves by absolute alcohol at −10°, both by direct titration as described above (determining the total hydrogen cyanide, free and as cyanohydrin, if any) and by precipitation with excess of silver nitrate solution and determination of the cyanide in the precipitate. The results show that for the most part the hydrogen cyanide is present in the free state, but they do not indicate with certainty whether a small quantity occurs in the form of an unstable compound. It is pointed out that in cyanogenetic plants a state of equilibrium exists between the aldehyde or ketone, the sugar, and the hydrogen cyanide, and the latter will be found in a free state when it is produced by the plant in a relatively larger proportion than the aldehyde or ketone and the sugar.

The author has isolated from the leaves of the *Phaseolus lunatus* the glucoside phaseolunatin obtained by Dunstan and Henry (Abstr., 1904, ii, 71) from the seeds of the same plant, and in agreement with these authors (Abstr., 1907, ii, 572), but contrary to the observation of Kohn-Abrest (Abstr., 1906, ii, 625), he has obtained it also from Java beans. E. H.

Biochemical Investigations on the Development of Anthocyanin in Plants. R. Combes (*Compt. rend.*, 1909, **148**, 790—792).—It is known that anthocyanin is formed in leaves under the action of strong light or of low temperatures. Overton has shown, also, that it is formed when plants grow in culture solutions containing sugar, and he suggests that its formation is in all cases due to excess of sugar in the cell sap. The author has examined a number of leaves which had turned red under the influence of autumn frosts or of strong light and compared them with green leaves. In all cases the red leaves contained more sugar (estimated after hydrolysis) and more glucosides than the green leaves; these results are quite in accordance with Overton's view. It does not appear that the insoluble carbohydrates have much to do with the formation of anthocyanin, since they are sometimes more and sometimes less in red than in green leaves. The plants examined were *Ampelopsis hederaceae*, *Rosa canina*, *Mahonia aquifolium*, *Sorbus latifolia*, and *Spirea paniculata*.

E. J. R.

Scatole and Indole in Wood of Celtis reticulosa. Christian A. Herter (*J. Biol. Chem.*, 1909, **5**, 489—492).—*Celtis reticulosa* is a tree which grows in Java. It is termed "filth wood" by the natives on account of the fæcal odour of the wood. Scatole has been obtained from it by Dunstan (Abstr., 1890, 191); this is confirmed; indole was also found in less amount; although indoleacetic acid was not found, the substances mentioned are believed to originate from tryptophan, and not to be synthesised from simpler substances. W. D. H.

Oil of Colocynth Seeds. Carlo Grimaldi and L. Prussia (*Boll. Chim. Farm.*, 1909, **48**, 93—95).—The constants of colocynth oil, which is best extracted from the seeds by means of carbon tetrachloride, are as follows: D^{15} 0·9289; D^{100}_{15} 0·8733; solidifying point, 14°; refractive index on Zeiss's butter refractometer, 78·2 at 15°, 72·3 at 25°, and 63·5 at 40°; thermal degree on the Tortelli thermo-oleometer, 86·4; acid number, 2·7; Hehner number, 90·72; saponification number, 191·7; Hübl iodine number, 120·37; Reichert-Meissl number, 0·32. The fatty acids of the oil give the following constants: D^{100}_{15} 0·8537; m. p. 29·2—30°; solidifying point, 26·2—27·2°; refractive index on Zeiss's butter refractometer, 56·7 at 30°, 51·5 at 40°, and 48·3 at 45°; acid number, 192·6; saponification value, 198·2; Hübl iodine number, 121·0; absolute iodine number (Tortelli and Ruggeri), 150·0; mean molecular weight of the insoluble fatty acids, 272·0. The liquid fatty acids constitute 56·2%, and the solid ones 43·8%, of the whole.

The oil has slight drying properties, and is similar in all its characters to the oils of other cucurbitaceous seeds.

The colour reactions of the oil are given. T. H. P.

A Simple Method for Detecting Benzoic Acid in Cranberries. Anton Nestler (*Ber. deut. bot. Ges.*, 1909, **27**, 63—70).—The amount of benzoic acid in cranberries (*Vaccinium vitis idaea*) is surprisingly large, in view of the fact that it acts as a preservative, and has been estimated at 0·05 to 0·08% in the fresh berry and 0·45% in the dried. The dried berries are placed in a covered watch-glass and warmed with a small flame; free benzoic acid sublimes, condenses on the cover, and may be recognised by its appearance under the microscope and its behaviour towards sodium hydroxide followed by hydrochloric acid. The method is so sensitive that even a single berry, which would contain about 0·0001 gram of benzoic acid, gives a distinct reaction. Larger quantities of benzoic acid are readily obtained by extracting a number of berries with ether, evaporating the extract, and subliming the residue.

Benzoic acid was found in all parts of the fruit and in the seeds, but not in the leaves or stalks. *Vaccinium oxycoccus* also contained benzoic acid, although in smaller quantity than *V. vitis idaea*. *V. myrtillus* (bilberry) and *V. uliginosum* contained none. E. J. R.

Stachyose from White Jasmine. J. VINTILESCO (*J. Pharm. Chim.*, 1909, [vi], **29**, 336—339).—From the twigs of white jasmine a sugar has been isolated, the properties of which point to its being identical with Tanret's stachyose, $C_{24}H_{42}O_{21}$; a direct comparison of the two sugars confirms the correctness of the supposition.

C. S.

The Constants of Jasmine Flower Wax. LIONEL G. RADCLIFFE and J. ALLEN (*J. Soc. Chem. Ind.*, 1909, **28**, 227).—Jasmine flower wax is obtained by extracting the petals with light petroleum of low b. p. and then macerating the crude wax obtained with alcohol so as to extract the odoriferous matters. After drying, a specimen of the wax gave the following constants: solidifying point, 56—57°; refraction in Zeiss's butyrometer, 30 at 84°, 33 at 74°, 36 at 70°, 38 at 65°, 40 at 62°, 42 at 60°, 44 at 56°; acid value, 0·28; saponification value, 6·58; the saponification had to be carried out in the presence of amyl alcohol. Iodine value by Wys's method, 52—53°.

The fatty acids after having been freed from unsaponifiable matter by repeated treatment with light petroleum in the presence of an alkali show a mean mol. weight of 398 and an iodine value of 39%. The mixed fatty acids when crystallised from boiling alcohol melt between 57° and 65°.

The unsaponifiable matter when crystallised from ether melts sharply at 64°. It probably contains alcohols, but it has not yet been successfully investigated. L. DE K.

"Oleuropein" from Olive Leaves. FREDERICK B. POWER and FRANK TUTIN (*Pharm. J.*, 1908, iv, **27**, 714—715. Compare Abstr., 1908, i, 994.)—Bourquelot and Vintilesco are wrong in supposing that the authors had not given proof of the existence of a glucoside in olive bark (Trans., 1908, **93**, 891). The "oleuropein" obtained from olive leaves by Bourquelot and Vintilesco is not homogeneous and is not a chemical individual. G. B.

Fruit of Viburnum nudum. ROBERT H. LOTT (*Chem. News*, 1909, **99**, 169).—The fruit of this shrub was gathered about the end of August, 1907, in the swampy district around Sylvan Beach, New York. An alcoholic extract of the berries reacted acid towards litmus, and when freed from alcohol by distillation left a dark thick syrup and a blue, resinous, gummy substance. The amount of sugar found present in the sugar extract was 42·85%, and probably consisted of dextrose and lævulose. An average of four estimations gave 4·3% of ash, the composition of which was:

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	SO_3.	P_2O_5.
2·11	3·88	3·88	7·66	1·87	12·87	16·79	27·14	12·89

The dried berries from the sugar extraction were digested with ether and the ethereal extract treated with bone charcoal, when an amber-coloured oil was obtained, having D 0·9353, b. p. 82°, and an odour resembling olive oil. Saponification results indicate that this oil is one of the oleins in the same group as castor oil and olive oil; the acids separated were probably oleic and linoleic. Albumin containing sulphur was also present, and tests for acids made on the sugar extraction showed the presence of tartaric acid, a small quantity of malic acid, and larger quantities of citric acid. J. V. E.

Composition of Volcanic Soil from Java. JAKOB M. VAN BEMMELEN (*Chem. Weekblad.*, 1909, **6**, 199—215, 254).—The author gives the results of analyses of a number of samples of volcanic soil from Java. A. J. W.

Nitrification of Soils in situ. ISIDORE POUGET and GUIRAUD (*Compt. rend.*, 1909, **148**, 725—727).—Determinations were made of the amount of nitrates present in two uncultivated and uncropped plots at the School of Agriculture, Maison-Carrée, Algeria. A colorimetric method was used. During the wet months (January to April) the soil is almost depleted of nitrates, but nitrification does not at once begin when drier, warmer weather sets in. Throughout May, very little nitrate was found. Later on, the authors consider that denitrification takes place. E. J. R.

Production of Nitric Acid in Humus and Peat Soils. FR. WEIS (*Bied. Zentr.*, 1909, **38**, 145—148; from *Forstl. Forsögsväs*, 1908, 257—296).—Results of monthly determinations of nitrates in two typical Danish humus soils from beech woods, free from calcium carbonate, showed (with one exception in July) that nitrates were invariably present, sometimes in considerable quantity. The greatest amounts of nitrates were found in the coldest months (November to February). The comparatively low results obtained in the warmer months are probably attributed to the absence of sufficient moisture for nitrification, or to the nitrates being to a great extent taken up by the trees. N. H. J. M.

Soil Fatigue. OSWALD SCHREINER and M. X. SULLIVAN (*J. Biol. Chem.*, 1909, **6**, 39—50).—The fatigue of soils, due to the growth of one kind of crop, is not altogether due to using up of ash constituents. The present experiments with the cow-pea show that organic substances are produced which cause infertility; one of these toxic materials was crystallised out. W. D. H.

The Action of Iron on Wine. J. AUGUSTE TRILLAT (*Compt. rend.*, 1909, 148, 792—795).—Iron, whether in the metallic state or in the form of certain salts, has an injurious effect on wine, causing a deposition of the colouring matter and the production of an odour and taste resembling that produced by age. The author has already shown that acetaldehyde is formed in red wine, and he finds that the effect of iron is simply to hasten this action and cause it to go on to a much greater extent. Acetal or ethyl acetate are formed at the same time. The deposit of colouring matter is brought about by the aldehyde. Other factors, such as the amount of air present and the composition of the wine, also influence the reaction, but in the main it appears that iron simply accelerates the processes naturally taking place, and thus brings about an artificial "ageing" of the wine. The processes are, however, sufficiently distorted to spoil the wine.

E. J. R.

Effect of Mineral Manures on Certain Cyperaceae. J. B. GÈZE (*Compt. rend.*, 1909, 148, 727—730).—The experiments show that nitrogenous manures increased the yield of *Carex riparia* and *C. stricta*. Phosphates and potassium had no decided influence. E. J. R.

Feeding Value of Cereals as Calculated from Chemical Analyses. JOSEPH S. CHAMBERLAIN (*U.S. Dept. Agric., Bureau Chem. Bul.* 120, 1909).—Cereal grains may be divided into three groups, represented by (1) oats, as a typical muscle or energy producing food, (2) wheat, and (3) maize as a fat or heat producing food. The oats group includes emmer (*Triticum dicoccum*) and einkorn (*T. monococcum*), which are nearly equal to oats in food value, whilst the maize group includes broom-corn millet (*Panicum miliaceum*) and the non-saccharine sorghum (*Andropogon sorghum*), which are lower in food value than maize itself, but equal the oat group. The wheat group, including barley and rye, which are nearly equal to wheat in food value, is intermediate between the oats and maize groups.

The introduction of foreign varieties of cereals into the United States has resulted in increased amounts of protein in oats and barley.

Detailed analytical and calculated results are given.

N. H. J. M.

Nitrogen Compounds in Rain and Snow. FRANK T. SHUTT (*Trans. Roy. Soc. Canada*, 1909, [iii], 2, Sect. III., 181—185. Compare Abstr., 1908, ii, 422).—Analyses of rain and snow during the year March, 1907, to February, 1908. The average results for the year are as follows:

	Nitrogen per million.			Nitrogen per acre (lbs.).			
Rainfall. inches.	As ammonia.	As nitrates.	Albuminoid.	As ammonia.	As nitrates.	Albuminoid.	Total.
37·35	0·296	0·134	0·082	2·502	1·134	0·692	4·328

The percentages of nitrogen as ammonia and as nitrates in the total nitrogen (excluding organic N) were 68·8 and 31·2 respectively.

The actual amount of rain was 24·05 inches, the rest, 13·3 inches, being snow (equivalent to 133 inches), and it is estimated that about 75% of the total nitrogen was supplied by the rain and 25% by snow.

Separate analyses of rain (46) and of snow (32) showed that both contain about the same amount of nitrogen as nitrates and nitrites, whilst the rain was found to contain nearly twice as much ammonia, and three times as much albuminoid ammonia as snow.

Results were obtained indicating that snow has a slighter solvent or absorbent action than rain. A fall of snow, 8·75 inches (=0·875 inch of rain), early on December 30 contained 0·09, 0·115, and 0·086 per million of nitrogen as ammonia, as nitrates, and as organic matter respectively. This was followed shortly afterwards, 10·30 a.m., by 0·15 inch of rain containing 0·238, 0·582, and 0·271 per million of nitrogen in the respective forms. N. H. J. M.

Nitric Acid and Agriculture. L. Grandeau (*Bied. Zentr.*, 1909, 38, 148—150; from *Ann. sci. agron.*, 1906, II, 256—277).—Experiments with various crops grown in plots of five are, without manure, with minerals alone, and with minerals and nitrogen respectively. The soil was a poor sand containing N, 0·005; P_2O_5, 0·063; K_2O, 0·173, and CaO + MgO, 0·180%. The average yields during eight years were 10,500 kilos, without manure, 11,840 kilos, with minerals only, and 17,700 kilos. per hectare with nitrogenous and mineral manure; so that whilst minerals alone gave an increase of only 11·3%, minerals in conjunction with nitrogen increased the yield 40·1%.

In an experiment with potatoes manured with calcium and sodium nitrates, it was found that whilst sodium nitrate more than doubled the yield, the calcium salts produced a still greater increase.

N. H. J. M.

Can Calcium Cyanamide with a large Amount of Calcium Carbide Act Injuriously on Vegetation? Hjalmar von Feilitzen (*Deut. landw. Presse.* 1909, 36, 327. Compare Aeby, *Chem. Zeit.*, 1909, 145, and Haselhoff, *Landw. Versuchs-Stat.*, 1908, 68, 189).—Pot experiments, in which oats were grown in sand, showed that only about half or two-thirds of the seeds produced plants when Norwegian cyanamide, containing 5·5% of carbide, and Swedish cyanamide, containing 0·1%, were applied at the same time. When the two preparations of calcium cyanamide were applied fourteen days before sowing the seed, no injurious action was observed. Even considerable amounts of unchanged calcium carbide are therefore harmless, provided that the manure is applied in good time. N. H. J. M.

Analytical Chemistry.

Substitute for Forceps and for Triangles in Desiccators: Article for General Laboratory Use. C. W. EASLEY (*J. Amer. Chem. Soc.*, 1909, 31, 463—464).—A crucible holder is described which consists of a brass ring and handle, and enables the crucible to be readily removed from the desiccator without employing forceps or taking off the lid of the crucible. Three adjustable brass screws, 120° apart, pass through the ring near the lower edge; the top of each screw is bored, and a short piece of platinum wire, 1 mm. in diameter, is inserted; it is on these that the crucible rests. The holder can also be used as a substitute for the platinum triangle. E. G.

New Forms of Percolating and Extraction Apparatus. KARL VON DER HEIDE (*Zeitsch. Nahr. Genussm.*, 1909, 17, 315—320).—In the first apparatus described, the solution to be extracted by percolation is placed in a wide tube, the lower end of which is drawn out and fits into the neck of the boiling flask. The ether vapour coming from the latter passes up a side-tube, reaching nearly to the top of the apparatus, and then downwards through a tube surrounding the side-tube and entering the bottom of the tube containing the solution. The ether vapour bubbles through the solution, and the condensed ether flows back again into the flask through a central tube reaching downwards below the surface of the solvent in the flask. A spiral condenser which fits into the apparatus is also described. In another form of the apparatus, the ether vapour passes up into a condenser, and the ether then falls through a central tube to the bottom of the wide tube containing the solution to be extracted. Perforated inverted cups fitted round the outside of the central tube cause the ether to mix with the solution, and a side-tube allows the ether to flow from the top of the apparatus back into the flask. A modified form of this apparatus is described, which may be used with either ether or chloroform as the solvent. A modified Soxhlet apparatus shown consists of the ordinary wide tube for containing the cartridge; this tube is surrounded by another tube, and the syphon is arranged in the space between the two. The ether vapour also passes up this space and enters the inner tube through a series of holes at the top of the inner tube. W. P. S.

Munroe Crucible. WALTER O. SNELLING (*J. Amer. Chem. Soc.*, 1909, 31, 456—461).—Munroe (Abstr., 1888, 1333) has recommended a crucible of the Gooch pattern, in which the asbestos filtering medium is replaced by platinum felt. As this crucible possesses many advantages and is not yet generally known, the methods of preparing the felt and using the crucible are again described. E. G.

A System of Qualitative Analysis for the Common Elements. [IV.] Analysis of the Alkaline Earths and Alkali Groups. WILLIAM C. BRAY (*Tech. Quart.*, 1908, 21, 450—489. Compare Abstr., 1908, ii, 538).—The barium, calcium, strontium, and also the magnesium are precipitated jointly as carbonates by adding an excess of ammonia and ammonium carbonate and some alcohol. The filtrate is evaporated to dryness, and the residue heated to expel ammonium salts. After dissolving in a little water, one-third of the solution is mixed with sodium hydroxide and phosphate, also with some alcohol, which causes a precipitate of lithium phosphate. The filtrate is then tested for potassium with sodium cobaltinitrite. The remainder of the solution is evaporated with hydrofluoric acid to remove any lithium as fluoride, and sodium is then tested for with potassium metantimoniate.

The carbonates are dissolved in acetic acid, and the barium is precipitated with potassium chromate. The strontium is then also precipitated as chromate by adding ammonia and some alcohol, and to the filtrate ammonium oxalate is added to remove the calcium. Finally, the magnesium is precipitated with ammonia and sodium hydrogen phosphate.

For minute details, and a large number of interesting test experiments, the original article should be consulted. L. DE K.

Estimation of Acids Contained in Hydrogen Peroxide. HERMANN ENDEMANN (*Zeitsch. angew. Chem.*, 1909, 22, 673—674).—The author states that when titrating commercial hydrogen peroxide with standard alkali and phenolphthalein in the cold, only half of the acidity present is found, so, consequently, the result must be multiplied by two. Better results are obtained by adding to 50 c.c. of the sample 10—15 c.c. of $N/5$-sodium hydroxide and heating until no more oxygen is evolved; this may be much accelerated by adding some pieces of platinum wire. When cold, the excess of alkali is titrated with $N/5$-hydrochloric acid.

A qualitative analysis will reveal the nature of the acid impurity.

L. DE K.

Application of Urine to the Detection of Oxidising Substances. JUAN FAGES VIRGILI (*Anal. Fis. Quim.*, 1908, 6, 519—523; *Ann. Chim. anal.*, 1909, 14, 129—132).—The following procedure is recommended as a test for minute traces of certain oxidising agents. To a small quantity of the substance in a test-tube (a fragment to 1 gram, if solid, or a drop to 1 c.c., if liquid), 1 c.c. of urine is added, and four times the volume of hydrochloric acid, D 1·12; on mixing, a purple coloration appears more or less rapidly, depending on the nature and amount of the oxidising agent present. As traces of ferric chloride (or chlorine) are often present in hydrochloric acid in sufficient quantity to produce a faint purple coloration, even when other oxidising substances are not present, the test should always be made by comparison with a blank, using urine and hydrochloric acid alone. Relatively large quantities of oxidising agents either do not produce the purple coloration, or it is fugitive, giving place to a clear yellow colour; the purple substance is easily oxidised to higher oxidation products.

By means of the test, 0·000003 gram of potassium chlorate can be detected, and about the same weight of hydrogen peroxide. It is more delicate than the method based on the use of aniline hydrochloride (this vol., ii, 179), with which it may be advantageously combined as a means of detecting either very small or larger quantities of oxidising substances as follows. To the solution prepared for the test as above, 4 volumes of the hydrochloric solution of aniline hydrochloride are added. Traces of an oxidising agent produce a purple colour, larger quantities a blue or green coloration, following the purple.

The urine test responds to the oxidising compounds to which aniline hydrochloride is sensitive (*loc. cit.*), and, in addition, to traces of bromine, nitrites, nitrates, free nitric acid, ferric chloride, and molybdates (slowly). Bromides, which hinder the aniline test, do not affect the urine test, but iodides must not be present in either case. W. A. D.

Detection and Estimation of Chlorates in Urine. Juan Fages Virgili (*Anal. Fis. Quim.*, 1909, 7, 56—63).—The facts recorded in two previous papers (this vol., ii, 179, and preceding abstract) are applied to the detection and estimation of chlorates in urine.

Detection.—To 1 c.c. of urine, 4 c.c. of the solution *A* or *B* of aniline hydrochloride are added. If chlorates are absent, no change of colour occurs, but minute traces of a chlorate produce a purple colour, due to the action of the chlorate and hydrochloric acid on the chromogenic substances present in the urine; when a chlorate is present in larger proportion, the purple colour, if produced at first, is soon destroyed by the excess of chlorate, but in this case the aniline hydrochloride betrays the presence of this excess by producing a characteristic blue coloration. When the proportion of chlorate in a urine is very small, the test for chlorate can be carried out by adding hydrochloric acid (4 vols.) to the urine, when the purple coloration is developed, changing to yellow if more than a trace of chlorate be present. The colour test is not available in the presence of the oxidising compounds enumerated in the previous papers.

Estimation.—This is effected colorimetrically by a method analogous to that already described (*loc. cit.*). One c.c. of urine (suitably diluted if necessary), containing not more than 0·0025 gram or less than 0·0020 gram of chlorate, is mixed with 5 c.c. of water, and 25 c.c. of solution *A* or 20 c.c. of solution *B* added. The colour is compared (after twenty minutes in the case of *A* or ten minutes in the case of *B*) with that of a series of solutions freshly prepared by mixing 1 c.c. of urine free from chlorate with 5, 4·75, 4·5, 4·25, and 4 c.c. of a solution of 0·5 gram potassium chlorate per litre, in each case diluting exactly to 6 c.c., and adding 25 c.c. of solution *A* (or 20 c.c. of *B*). The results obtained are very good.

Another method suitable for very small quantities of chlorate (0·1 to 0·5 gram $KClO_3$ per litre) consists in adding sufficient of the dilute standard solution of potassium chlorate to make the coloration equal in intensity to that given by a urine containing a known proportion of chlorate; the quantity of chlorate originally present is then obtained by difference. W. A. D.

The Reduction and Estimation of Perchlorates. Victor Rothmund (*Zeitsch. anorg. Chem.*, 1909, **62**, 108—113).—Perchlorates are not reduced by the ordinary reducing agents, or by electrolytic means. Reduction has been performed by Tommasi (*Ber.*, 1879, **12**, 1701) with hyposulphites, and by Sjollema (Abstr., 1905, ii, 21) with ferrous hydroxide, but neither of these methods gives accurate quantitative results. A practically complete reduction is obtained by using titanous sulphate, about twice the theoretical quantity of which is boiled with the perchlorate solution in a current of carbon dioxide. The excess of titanous sulphate is then removed by means of permanganate, and the chlorine titrated by Volhard's method. The titanous salt remaining may also be titrated with ferric alum (Knecht, Abstr., 1908, ii, 627), but this method is less convenient, as it requires the complete exclusion of air.

Nitrates, if present, must first be removed, for instance, by electrolytic reduction. In addition to titanium salts, the lower salts of vanadium and molybdenum reduce perchromates, tungsten salts act much more slowly, and chromous salts only to a minute extent after many hours' boiling.

The difference between reducing agents in this respect is entirely one of specific velocity, and not of potential; thus in the series zinc–chromium–vanadium–titanium, the first two ions, with a high reduction potential, are the least active, whilst titanium, the potential of which lies below that of hydrogen, acts most rapidly. The reaction furnishes an additional example of a reduction process accelerated by the presence of metals capable of existing in more than one state of oxidation. C. H. D.

Acidimetric Estimation of Alkali Iodides. Erwin Rupp and F. Pfenning (*Arch. Pharm.*, 1909, **247**, 108—110).—A method of estimating alkali iodides has been devised, based on the reactions: $2Hg(CN)_2 + 2KI = Hg(CN)_2,HgI_2,2KCN$; $Hg(CN)_2,HgI_2,2KCN + 2HCl = Hg(CN)_2 + 2KCl + HgI_2 + 2HCN$ (compare Rupp and Goy, this vol., i, 295).

The estimation is performed as follows: the neutral solution of 0·5—1·5 grams of the iodide is added to a solution of 1—2 grams of mercuric cyanide in 30—50 c.c of water, together with a small quantity of potassium chloride and 25 c.c. of $N/2$-hydrochloric or sulphuric acid. The total volume is made up to 100 c.c., filtered, and the excess of acid in 50 c.c. of the filtrate ascertained by means of standard alkali, using methyl-orange as indicator: 1 c.c. of $N/2$-acid = 0·0635 gram of iodion. W. H. G.

Apparatus for Estimating Oxygen in Peroxides. George F. Jaubert (*Rev. gen. Chim. pure app.*, 1909, **12**, 63—67).—The peroxide is weighed or measured into a conical flask, furnished with a side-tube or appendix, into which manganese dioxide has been previously introduced. A little water is added together with the peroxide. The flask is closed by a perforated stopper, through which passes a glass tube which can be joined by means of stout indiarubber tubing to a calibrated, cylindrical gas-holder standing in a cylinder of water. At the commencement of the experiment, the water within and without the gas-holder is at the same level, which is indicated by zero on the gas-holder. This vessel and the flask are now joined by means of the indiarubber tubing, and the manganese dioxide is rinsed, by means of the water first added, into the body of the flask with the peroxide which it decomposes, and the liberated oxygen displaces some of the water in the gas-holder. When the water levels are again adjusted, the reading on the graduated gas-holder indicates the volume of active oxygen evolved from the peroxide. F. M. G. M.

Estimation of Sulphur in Coals and Cokes. Max Dennstedt (*Zeitsch. angew. Chem.*, 1909, 22, 677—678).—A reply to Holliger's criticisms (this vol., ii, 343). The author upholds the accuracy of his own process. L. de K.

Estimation of Sulphuric Acid as Barium Sulphate. Ernst Ruppin (*Chem. Zeit.*, 1909, 33, 398. Compare this vol., ii, 180).—The author attributes the discrepancy between the results obtained by Sacher (this vol., ii, 344) and by Folin (Abstr., 1906, ii, 123) to the fact that, although the solubility of barium sulphate in cold water is 2·5 mg. per litre, this solubility becomes less in presence of barium chloride, but in the hot washings it dissolves to a slightly larger extent. The solubility is increased also by several chlorides (alkalis, alkaline earths). L. de K.

Quantitative Separation of Sulphates and Fluorides. Richard Ehrenfeld and A. Indra (*Chem. Zeit.*, 1909, 33, 375—376).—The mixed sodium fluoride and sulphate is heated in a Rose's crucible with ten times its weight of zinc dust for half an hour over a powerful burner in a current of hydrogen or purified coal gas. After cooling in the reducing gas, the crucible is at once placed in a suitable distilling apparatus, a little precipitated silica and alumina are added, and the sulphide formed is decomposed by heating with dilute sulphuric acid in a current of carbon dioxide. The hydrogen sulphide is absorbed in a ten-bulb tube containing standard iodine, and to guard against loss of iodine another bulb tube is attached containing standard thiosulphate, which is afterwards united with the iodine solution. The excess of thiosulphate is then titrated with iodine. L. de K.

Mitscherlich's Method for Estimating Very Small Quantities of Nitrogen. D. J. Hissink (*Chem. Weekblad*, 1909, 6, 229—231. Compare Ringer and Klingen, Abstr., 1908, ii, 320).—A method for estimating small quantities of nitrogen is described. It is accurate to ± 0·01 mg. of nitrogen. 250—800 c.c. of the liquid are placed in a litre flask, 3 grams of Devarda's alloy added, and the flask closed with a Hugershoff's delivery tube, the open end of which dips into a solution of 10 c.c. of *N*-sulphuric acid in 50 c.c. of water contained in a ½-litre flask. The liquid in the first flask is heated with 50 c.c. of concentrated sodium hydroxide until distillation is complete, the nitrogen from the ammonia, nitrates, and nitrites passing over as ammonia, and the organic nitrogen remaining behind. The organic nitrogen is heated with a mixture of 50 c.c. of water and 60 c.c. of concentrated sulphuric acid, the reaction being complete thirty minutes after foaming has ceased. After mixing, the contents of the two flasks are distilled with 120 c.c. of concentrated sodium hydroxide into a mixture of 10 or 25 c.c. of *N*/50-sulphuric acid with 50 c.c. of water. The distillate is titrated back with *N*/50-sodium hydroxide, with a 1/10% solution of Congo-red in 50% alcohol as indicator. A. J. W.

Estimation of Total Nitrogen by Mitscherlich's Method. E. Merres (*Zeitsch. angew. Chem.*, 1909, 22, 631—632).—The process, which is intended for small quantities of nitrogen, is briefly as follows. The substance is heated in a Kjeldahl flask, fitted with a Hugershoff cooling arrangement, with 200 c.c. of water and 50 c.c. of aqueous sodium hydroxide and a few grams of Devarda's alloy. The nitric nitrogen is converted into ammonia, and this, together with some ammonia derived from organic matter, is absorbed in a second Kjeldahl flask containing 100 c.c. of pure sulphuric acid, D 1·6. When some 50 c.c. are left, the flask is allowed to cool, when the sulphuric acid will be drawn into the flask. The operation of boiling and cooling is repeated three times. The contents are then boiled until the liquid assumes a bluish-green colour, showing the complete destruction of the organic matter, and consequent conversion of the organic nitrogen into ammonia. When cold, the mass is dissolved in water, the liquid is distilled with excess of alkali, and the ammonia titrated in the usual manner. Silica condensing tubes are recommended. L. de K.

Method for the Estimation of Nitrogen in Organic Substances, and, in particular, for the Estimation of Hide Substance in Leathers and of Dissolved Hide Substance in the Soak Liquors and Lime Liquors of the Leather Factory. Hugh Garner Bennett (*J. Soc. Chem. Ind.* 1909, 28, 291—292).—In the method proposed, the organic matter is decomposed with sulphuric acid as in the ordinary Kjeldahl process, and the ammonia formed is titrated after the addition of formaldehyde, as described by Ronchèse (Abstr., 1907, ii, 651). The substance is digested with sulphuric acid until a colourless solution is obtained, and the excess of acid is then neutralised by the addition of sodium hydroxide, using phenolphthalein as indicator. Neutral formaldehyde solution is next added, and the sulphuric acid, set free by the combination of the aldehyde with the ammonia, is titrated with *N*/10-sodium hydroxide solution. Each c.c. of *N*/10-sodium hydroxide is equivalent to 0·0014 gram of nitrogen. W. P. S.

Estimation of Nitrates by Grandval and Lajoux's Method. Maurice Lombard and J. Lafore (*Bull. Soc. chim.*, 1909, [iv], 5, 321—323).—The estimation depends on the formation of coloured derivatives of phenol by the action of free nitric acid. The product is not picric acid or a picrate. Lajoux noted that his method is not accurate in presence of chlorides. As the quantity of chloride increases, the coloration decreases. The authors consider that some nitric acid is carried away by the hydrogen chloride evolved, and reject the theory of Perrier and Farcy (this vol., ii, 344), that hydrogen chloride attacks the nitrophenols produced. R. J. C.

Estimation of Phosphoric Acid in Manures by Pemberton's Modified Process and by von Lorentz's Method. D. J. Hissink (*Chem. Weekblad*, 1909, 6, 181—191).—A series of experiments showing that the results obtained by the author's modification of Pemberton's process (titration of the molybdate precipitate, Abstr., 1905, ii, 419) and by von Lorenz's gravimetric process (direct weighing of the yellow precipitate) are both equally satisfactory. L. de K.

Volumetric Estimation of Small Quantities of Arsenic. Launcelot W. Andrews and Henry V. Farr (*Zeitsch. anorg. Chem.*, 1909, 62, 123—128).—Arsenic is best estimated, when present in more than traces, by a modification of Bettendorff's method (*Zeitsch. anal. Chem.*, 1869, 9, 105). The carrying down of tin in that process is prevented by the addition of tartaric acid.

The solution containing arsenic is neutralised, evaporated to 15—20 c.c., and transferred to a flask of 80—100 c.c. capacity with ground-in stopper. Forty to fifty c.c. of a solution, prepared by dissolving 20 grams of crystallised stannous chloride and 40 grams of tartaric acid in 1 litre 40% hydrochloric acid, is added. The stopper is inserted, and the flask kept in a warm place until all the arsenic is precipitated. This requires two to three hours at 40°. The arsenic is collected on an asbestos filter, and washed first with a little hydrochloric acid, which must be free from chlorine, and then with water. The filter is then transferred to the flask with an excess of $N/10$- or $N/100$-iodine solution, calculated from the equation $As + 5I + 7NaHCO_3 = Na_2HAsO_4 + 5NaI + 7CO_2 + 3H_2O$, sodium hydrogen carbonate being added to maintain neutrality. When all is dissolved, the excess of iodine is titrated with arsenite solution. A number of test analyses are given. The method may be applied to arsenic mirrors obtained by the Marsh process. C. H. D.

Micro-sublimation Test for Arsenic Trioxide. C. Hartwich and F. Toggenburg (*Chem. Zentr.*, 1909, i, 580; from *Schweiz. Woch. Chem. Pharm.*, 1908, 46, 831—834).—A glass tube of about 12 mm. diameter and 10 mm. in height is placed on a watch-glass. Into the tube is introduced the arsenical substance. The watch-glass is placed over a micro-burner, and the cylinder is covered with a plate of glass 50 mm. square. The flame should not exceed 5 mm. in height, and should be at 30—40 mm. distance from the watch-glass. After heating for ten to fifteen minutes, the whole is allowed to cool slowly, and the glass slide is then examined; even 0·01 mg. of arsenic trioxide gives a visible sublimate. The sublimate may be further identified by the silver reaction.

L. de K.

New Apparatus for the Estimation of Carbon. A. Kleine (*Chem. Zeit.*, 1909, 33, 376).—*Carbon Flasks.*—These are distinguished from the well-known Corleis flasks, not only by a superior cooling arrangement, but also by having a flat bottom and no lateral tube. Above the orifice of the air-tube is introduced a hole, which prevents an explosion in case of an obstruction occurring. To the air-tube is fixed a hook with an elevation in the middle. The long wire of the little bucket containing the substance is pushed over the elevation, the bucket is suspended to the point of the hook, and the cooling arrangement is inserted. After passing a current of purified air, the apparatus is slightly shaken and inclined, thus causing the bucket to slide from the point of the hook and empty its contents into the chromic acid mixture; it, of course, remains suspended to the long wire, and is readily removed from the flask.

Soda-lime Tubes.—These differ from the ordinary pattern in so far that into the middle of the left arm is inserted a glass disk containing three tubes, on which rests the asbestos, which is then covered with a layer of phosphoric anhydride. The other part of the tube is filled with soda-lime. The advantage of this arrangement is that no liquefied acid can come into contact with the soda-lime. L. DE K.

Examination of Carbon Tetrachloride. LIONEL G. RADCLIFFE (*J. Soc. Chem. Ind.*, 1909, 28, 229—230).—After trying experiments to estimate the amount of carbon disulphide in commercial carbon tetrachloride by fractional distillation, density, and refraction, the following slight modification of Gastine's method was found to give satisfactory results. A flask containing 25 c.c. of alcoholic potassium hydroxide, and loosely corked, is accurately weighed, about 1 c.c. of the sample is introduced, and the flask is re-weighed. After five minutes, the mixture is rendered slightly acid with dilute acetic acid, using phenolphthalein as indicator. Water is added and then an excess of solid sodium hydrogen carbonate, and the milky liquid is titrated with $N/10$ iodine, using starch as indicator. Two atoms of iodine = 1 mol. of carbon disulphide. L. DE K.

Estimation of Carbon Dioxide in the Atmosphere. SAMUEL H. DAVIES and BASIL G. McLELLAN (*J. Soc. Chem. Ind.*, 1909, 28, 232—234).—A modification of the Lunge-Zeckendorf process. Fresh air is forced through 25 c.c. of barium hydroxide solution, coloured with phenolphthalein of such strength that it will be decolorised by 15 strokes (being one over 14 actually required) of a pump delivering 50 c.c. per stroke. Having thus standardised the barium hydroxide, the apparatus may then be used for testing the air in rooms, etc.

A table is given showing the amount of carbon dioxide per 10,000 parts of air corresponding with the number of strokes (+1) required in the experiment. L. DE K.

Application of Alkaline Phosphate Solutions in Analysis. HERMANN GROSSMANN (*Chem. Zeit.*, 1909, 33, 385—386).—An adverse criticism of the analytical course for the separation of metals proposed by Pozzi-Escot (Abstr., 1908, ii, 892). L. DE K.

The Iodometric Estimation of Silver, Potassium Chromate being Employed as Precipitating Agent. FRANK A. GOOCH and ROLAND S. BOSWORTH (*Zeitsch. anorg. Chem.*, 1909, 62, 74—76).—It has been shown that silver is precipitated quantitatively by an excess of potassium chromate (this vol., ii, 346). The excess of potassium chromate remaining in the filtrate may be estimated by adding potassium iodide and sulphuric acid, and titrating the iodine set free with thiosulphate. Since a large excess of chromate is necessary when the silver is present as nitrate, more rapid results are obtained by dissolving the precipitate of silver chromate in ammonia, boiling to re-precipitate, and dissolving the washed crystalline chromate in a concentrated solution of potassium iodide, diluting, acidifying with sulphuric acid, and titrating with thiosulphate. C. H. D.

Assay of Commercial Magnesite. Estimation of Small Quantities of Calcium in Presence of much Magnesium. Franz Hundeshagen (*Zeitsch. öffentl. Chem.*, 1909, 15, 85—93).—A criticism of the oxalate process, which the author asserts to be unsuitable for the estimation of calcium in magnesite. The following process is recommended: One gram of the mineral is ignited, the residue is dissolved in dilute hydrochloric acid, and the filtrate is evaporated to dryness on the water-bath to expel the excess of acid. The residue is then dissolved in 30 c.c. of water with addition of 4 grams of sodium sulphate crystals, and 40 c.c. of strong alcohol are added. After remaining for four to five hours (in the covered basin), the calcium is precipitated completely as sulphate, which is then washed with dilute alcohol. To free it completely from magnesium, etc., it is re-dissolved in hydrochloric acid and treated with ammonia and ammonium oxalate as usual.

The joint magnesium and calcium may be estimated by boiling 0·5 gram of the mineral with standard sulphuric acid and titrating the excess of acid with standard sodium carbonate. The calcium may then be precipitated as sulphate by adding a sufficiency of alcohol.

L. de K.

Colour Test for Salts of Zinc. Angel del Campo (*Anal. Fis. Quim.*, 1909, 7, 63—69).—The production of a deep blue colour by the interaction of resorcinol and an ammoniacal solution of a zinc salt (Carobbio, Abstr., 1906, ii, 809) serves as a means of detecting traces of zinc salts. To the ammoniacal solution containing zinc, 1 c.c. of a 0·5% ethereal solution of resorcinol is added, so as to form a separate layer; with quantities of zinc exceeding 0·0005 gram per c.c. of solution, a deep blue coloration develops at the junction of the two layers instantly or in a few minutes. The test serves to detect as small a quantity as 0·000005 gram of zinc per c.c., but in this case the coloration develops only after about an hour.

Cadmium salts produce a green colour instead of blue with resorcinol, and copper salts a black precipitate. Traces of zinc can be detected in presence of copper by one of the following methods: (*a*) The solution containing copper is decolorised by potassium cyanide, ammonia added, and then the ethereal solution of resorcinol. A blue coloration is produced only when traces of zinc are present; when the quantity of zinc is very small, the coloration is green. (*b*) Hydrochloric acid is added after the blue coloration has been formed on adding the ethereal solution of resorcinol to an ammoniacal solution of the copper salt; if zinc is present, a red colour is developed and a red precipitate separates, which, when dissolved in amyl alcohol, develops an intense blue colour with ammonia. W. A. D.

Rapid Electro-analysis. H. FILIPPO, jun. (*Chem. Weekblad*, 1909, 6, 226—229. Compare Smith, Abstr., 1903, ii, 755; Kollock and Smith, Abstr., 1905, ii, 198, 859; 1906, ii, 194; 1907, ii, 719; Stoddard, this vol., ii, 347).—The author has devised a modification of Smith's method of rapid electro-analysis for estimating metals which has the advantage of allowing larger quantities of liquid to be manipulated. Thirty to sixty grams of distilled mercury are weighed out into a round-bottomed flask of moderate capacity. Through the bottom of the flask is sealed a platinum wire 0·5 mm. in diameter and 2 cm. long, the end of the wire being flush with the inside surface of the flask. The anode is a spiral of platinum wire, and its end is 1 cm. above the surface of the mercury cathode. A difference of potential of 6—10 volts and a current of 2—4 amperes are employed. The electrolysis requires twenty to seventy minutes, and has been applied to the estimation of mercury, silver, copper, and zinc. A. J. W.

Volumetric Estimation of Mercuric Salts. LAUNCELOT W. ANDREWS (*Zeitsch. anorg. Chem.*, 1909, 62, 171—172).—A reply to the criticisms of Morawitz (Abstr., 1908, ii, 185) of the author's method (Abstr., 1903, ii, 695). The proposed modification has no advantage over the original process. C. H. D.

Estimation of Clay in Soils. EMIL ARNTZ (*Landw. Versuchs-Stat.*, 1909, 70, 269—306).—The finely-ground soil (5 grams) is heated with 50 c.c. of water and 2 c.c. of hydrochloric acid (or more in the case of calcareous soils). The solution is filtered off, and the soil washed into a 300 c.c. beaker (12 cm. high and 6 cm. in diameter) and gently boiled for half an hour with 30 c.c. of 18—20% ammonia. When cold, water is added until it reaches a mark 11 cm. above the soil, and after twenty-four hours the liquid is removed by means of a pipette, turned up at the end, to within 1 cm. of the soil. The residue is rubbed with a little water, in a porcelain dish until the water remains clear, and both the residue and the decanted liquid are then boiled for fifteen minutes with 20 c.c. of ammonia. After cooling, water is added to the mark, the whole left for twenty-four hours, and removed as described above. The process is repeated three times, and the turbid liquid treated with ammonium chloride to precipitate the clay. The latter is added to the precipitate, containing iron and alumina from the first hydrochloric acid extract, washed, ignited, and weighed. The results obtained from soils containing 1—15, 15—30, and 30—50% of clay are divided by 0·99, 0·98, and 0·97 respectively.

When time permits, the washing process may be continued to the end, and, when necessary, the alumina can be determined in the product.

The method is considered sufficiently exact, and can be carried out in a relatively short time. N. H. J. M.

Estimation of Nickel in Nickel Steels by the Electrolytic Method and the Methods of Brunck and Grossmann. August Prettner (*Chem. Zeit.*, 1909, 33, 396, 411—412).—A full investigation as to the respective merits of the electrolytic process of estimating nickel in nickel steels and the processes recommended by Brunck (separation by means of dimethylglyoxime) and Grossmann (dicyanodiamidine sulphate reagent).

The author favours the Brunck or the Grossmann methods particularly when cobalt is present in some quantity, and where the direct cyanide titration process cannot be applied. L. de K.

Volumetric Estimation of Uranium. Herbert N. McCoy and Herbert H. Bunzel (*J. Amer. Chem., Soc.*, 1909, 31, 367—373). See this vol., ii, 406.

Estimation of Vanadic and Arsenic Acids and of Vanadic and Antimonic Acids, when present together. Graham Edgar (*Zeitsch. anorg. Chem.*, 1909, 62, 77—80).—Arsenic and vanadium are commonly associated in minerals, and their quantitative separation presents difficulties. The following method permits the estimation of both metals without separation.

The solution, containing arsenic and vanadic acids, is divided into two parts. One part is boiled with tartaric or oxalic acid until the vanadium is completely reduced to the blue tetroxide. After cooling, and nearly neutralising with potassium hydrogen carbonate, an excess of iodine solution is added. After addition of an excess of potassium hydrogen carbonate, the solution is allowed to remain one-quarter to one-half hour, and the remaining iodine titrated with arsenious acid. The oxidation with iodine takes place according to the equation $V_2O_4 + I_2 + H_2O = V_2O_5 + 2HI$.

The second portion is heated with sulphurous acid in a pressure flask for one hour in a water-bath, so as to reduce both the arsenic and the vanadic acids. After boiling off the sulphur dioxide in a current of carbon dioxide, the solution is oxidised with iodine as described above: $As_2O_3 + V_2O_4 + 3I_2 + 3H_2O = As_2O_5 + V_2O_5 + 6HI$. The difference between the two results gives the arsenic.

The same method is applicable to solutions containing vanadic and antimonic acids. C. H. D.

Determination of the Heating and Illuminating Values of Gas. Nicolae Teclu (*J. pr. Chem.*, 1909, [ii], 79, 165—171).—The method depends on the assumption that the force of an explosive mixture of gas and air is determined by the heating value of a gas. The apparatus consists of a litre flask provided with three openings, the upper fitted with a glass tube for igniting the gas, the lower for admission of air and gas, and a broad side-tube constricted at one end, on which rests loosely an aluminium cup of a pendulum. Gas is admitted to the apparatus and ignited at the upper tube, the supply is then cut off, the flame descends from the tube into the flask, where an explosion takes place, and an aliquot portion of the explosive wave is measured by the amplitude of the swing of the pendulum. A comparison of ordinary town gas and a mixture of hydrogen and marsh gas gave a superiority in heating value to the town gas of from 0·36 to 9·6%. The time which the flame remains at the top of the tube depends on the density of the gas and therefore on its illuminating power. This has also been measured, and the illuminating value of gas examined found to be 26 to 29% better than the mixture of marsh gas and hydrogen. The duration of burning and amplitude of swing are in close relationship, the ratio of the two values being a constant.

W. R.

A Colour Reaction for Colophony. J. Sans (*Ann. Chim. anal.*, 1909, 14, 140—141).—A very small quantity of colophony is placed in a test-tube, 1 or 2 c.c. of neutral methyl sulphate are added, and the whole is heated gently. A coloration is noticed passing from rose and violet to deep violet; on heating more strongly, the colour fades to a slight brown. The test may serve for the detection of colophony in soaps; other resins and gum resins do not give the test provided the reagent contains no free sulphuric acid. L. de K.

Detection of Reducing Sugars. Stanley R. Benedict (*J. Biol. Chem.*, 1909, 5, 485—488).—The alkali of Fehling's solution has a destructive influence on dextrose and other carbohydrates. Sodium carbonate does not have this disadvantage. Rochelle salt is objectionable on account of the change it may undergo; it should be replaced by sodium citrate. The following test solution is therefore recommended:

Copper sulphate	17·3	grams
Sodium citrate	173·0	,,
Sodium carbonate (anhydrous)	100·0	,,
Water	to 1000·0	c.c.

This is more sensitive than Fehling's solution, and has none of its disadvantages. W. D. H.

Titration of Diabetic Sugar. Erwin Rupp and F. Lehmann (*Chem. Zentr.*, 1909, i, 876; from *Apoth. Zeit.*, 24, 73—75).—Of urine, D 1023 or less, 50 c.c. are diluted to 100 c.c.; of urine, D 1023—1033, 25 c.c. are made up to 100 c.c., and of urine, above D 1033, 10 c.c. are taken. The urines, however, are at first diluted to about 85 c.c., 2—3 c.c. of basic lead acetate are added, and then 6—8 c.c. of sodium carbonate solution (1 + 4) to precipitate the excess of lead; water is then added up to 100 c.c. The titration is carried out as follows: 15 c.c. of Fehling's solution are heated to boiling, 20 c.c. of the filtrate of the urine are run in, the boiling is continued for two minutes, and the whole is cooled rapidly. The solution is then added to a solution of 2 grams of potassium iodide in 25 c.c. of dilute sulphuric acid, and the iodine liberated, which represents the excess of copper, is titrated with N/10-thiosulphate, using starch as indicator. L. de K.

Estimation of Reducing Substances in Blood. John J. R. Macleod (*J. Biol. Chem.*, 1909, 5, 443—452).—The methods of Waymouth Reid and Schenck are compared. The latter gives lower values for dog's blood than the former. This deficit is probably due to the mercuric chloride precipitating some reducing substances (glycuronic acid, jecorin, pentose (?), and combined dextrose) which are not precipitable by phosphotungstic acid. Reid's method is therefore recommended. W. D. H.

Glycogen Analyses by the Use of Dilute Potassium Hydroxide. BERNHARD SCHÖNDORFF, PETER JUNKERSDORF, and GEORG FRANCKE (*Pflüger's Archiv*, 1909, **127**, 274—279).—Treatment of organs with dilute alkali for periods as long as seventy-two hours does not destroy their glycogen. Subsequent treatment with 30% potassium hydroxide gives a full yield of glycogen. W. D. H.

Estimation of Furfuroids in Presence of Pentosans. D. H. BRAUNS (*Pharm. Weekblad*, 1909, **46**, 326—331).—The total percentage of pentosans, including furfuroids, in cocoa was found to vary between 1·6 and 0·06%, and that in the shell of cocoa-beans between 6·7 and 1·4%, hydrolysis being effected by heating with 2% sulphuric acid. The shell contains a cellulose-like substance, which is insoluble and either non-hydrolysable or difficult to hydrolyse. To this substance the name furfuroid has been given. A. J. W.

The Detection of Mineral Acids in Vinegar. FRANZ UTZ (*Oesterr. Chem. Zeit.*, 1908, [ii], 11, 321—328).—The author gives a résumé of the methods previously employed in detecting mineral acids in vinegar, and indicates the following process. About 10 c.c. of the vinegar is mixed with 4 to 5 grams of sucrose, and the latter inverted on the water-bath. The solution is extracted with ether, the extract evaporated, and the thoroughly dried residue treated with a few drops of a 10% solution of resorcinol in concentrated hydrochloric acid (D 1·19). A cherry-red coloration betokens the presence of small amounts of mineral acid in the original samples of vinegar. Large quantities lead to the development of a deep red coloration. In the absence of mineral acid the solution either remains colourless or develops merely a lemon-yellow tint. G. T. M.

Buignet's Method for the Estimation of Hydrocyanic Acid and the Titration of Cherry-Laurel Water; Correction and Modification. GABRIEL GUÉRIN and L. GONET (*J. Pharm. Chim.*, 1909, [vi], **29**, 234—236).—Buignet's method for the estimation of hydrocyanic acid (*ibid.*, 1859, [iii], **35**, 168), depending on titration with a standard solution of cupric sulphate in presence of ammonia, has become obsolete, owing to the difficulty of ascertaining the end-point, a rose colour changing gradually to mauve being obtained in place of the sky-blue tint due to excess of ammoniacal copper sulphate. This difficulty can be avoided by adding sodium sulphite to the liquid under titration. The equation representing the reaction as given by Buignet is inaccurate, and should be $CuSO_4 + 3NH_4CN = [NH_4]_2SO_4 + Cu(CN)_2,NH_4CN$. In titrating cherry-laurel water a small amount of sodium hydroxide should be added to prevent the formation of hydrobenzamide. T. A. H.

Partition-coefficient and its Application to the Estimation of Volatile Acids in Wines. Philippe Malvezin (*Compt. rend.*, 1909, **148**, 784—787; *Bull. Soc. chim.*, 1909, [iv], **5**, 332—335; *Bull. Assoc. chim. sucr. dist.*, 1909, **26**, 848—851).—The author finds that the coefficient of distribution for the volatile aliphatic acids between the solvents ether and 10% alcohol varies with the concentration of the acids, but is independent of the concentration of the non-volatile acids. Taking advantage of this, he has devised a rapid and accurate method for estimating the amount of volatile acids in wines. The wine is extracted with ether, which under certain conditions, for which the original should be consulted, dissolves 72% of the volatile acids present. Results obtained by this method were practically identical with those arrived at by the method of Duclaux (Abstr., 1896, ii, 504). W. O. W.

Estimation of Succinic Acid in Wine. Karl von der Heide and H. Steiner (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 291—307).—The authors have submitted the method described by Kunz (Abstr., 1903, ii, 701) to a critical examination, and consider it to be, with certain slight modifications, the most trustworthy one for the estimation of succinic acid. The modified process is carried out as follows: Fifty c.c. of the wine are evaporated in a basin to remove the alcohol, and the residual solution is treated with 1 c.c. of 10% barium chloride solution. Finely powdered barium hydroxide is then added, in small quantities at a time, until the mixture is neutral, a drop of phenolphthalein solution being added as indicator. The whole is then evaporated to a volume of 20 c.c., carbon dioxide is passed over the surface of the residue in order to remove any excess of barium hydroxide, and 85 c.c. of 96% alcohol are added, with constant stirring. Barium succinate, tartrate, malate, and other salts are precipitated quantitatively, whilst barium acetate and lactate remain in solution. After the lapse of two hours, the supernatant liquid is poured through a filter, the precipitate is washed once with 80% alcohol, and then rinsed back again into the basin with hot water. The contents of the basin are heated on the water-bath to expel the alcohol, and to the hot mixture is added 5% potassium permanganate solution until a red coloration is obtained. After the lapse of five minutes, a further 5 c.c. of permanganate solution are added, and the mixture is placed aside for fifteen minutes. Should the permanganate be reduced completely at the end of this time, more must be added. The excess of permanganate is destroyed by the addition of sulphurous acid, the mixture is then acidified with 25% sulphuric acid, and a further quantity of sulphurous acid is added until the precipitated manganese dioxide has re-dissolved. After evaporating to a volume of about 30 c.c., the solution is treated with 40% sulphuric acid, so that it shall contain about 10% of free acid, and is then extracted with ether in a percolating apparatus for twelve hours. The ethereal solution is evaporated, the residue is neutralised by the addition of chlorine-free $N/10$-sodium hydroxide solution, 20 c.c. of $N/10$-silver nitrate solution are added, the whole is diluted to a volume of 100 c.c., and filtered. The excess of silver is then titrated in a definite volume of the filtrate according to Volhard's process; 1 c.c. of *N*/10-silver nitrate solution = 0·0059 gram of succinic acid.

W. P. S.

Estimation of Malic Acid in Wine. KARL VON DER HEIDE and H. STEINER (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 307—315).—In the method proposed, the malic and succinic acids are separated together after the tartaric, acetic, and lactic acids have been removed, and their quantity estimated from the alkalinity of the ash of their alkali salts. Fifty c.c. of the wine are treated with 1 c.c. of glacial acetic acid, 0·25 c.c. of 20% potassium acetate solution, 7·5 grams of potassium chloride, and 7·5 c.c. of 95% alcohol. The mixture is well stirred, and, after fifteen hours, the crystalline precipitate is collected on a filter and washed three times with a small quantity of a solution containing 15 grams of potassium chloride, 20 c.c. of 95% alcohol, and 100 c.c. of water. The filter and precipitate are then washed three times with water, using not more than 10 c.c. in all, and the filtrate and washings are evaporated to a volume of a few c.c. When most of the acetic acid has been expelled, the residue is dissolved in a little water, 5 c.c. of 10% barium chloride solution are added, and then powdered barium hydroxide until the mixture is neutral. Carbon dioxide is introduced to remove any excess of barium hydroxide, the whole is evaporated to a volume of 20 c.c., and 85 c.c. of 96% alcohol are added. After two hours, the precipitate is collected on a filter, washed with 80% alcohol, redissolved in hot water, and the solution evaporated almost to dryness. The moist residue is treated with from 2·5 to 3 c.c. of 40% sulphuric acid, and sufficient anhydrous sodium sulphate is added to form a dry powder, which is then transferred to a cartridge and extracted with ether for six hours. From 10 to 20 c.c. of water are added to the ethereal extract, the ether is evaporated, and the remaining aqueous solution is treated with 3 grams of animal charcoal, the mixture being kept on a water-bath for one hour. The solution is next filtered, the precipitate, consisting of tannin, charcoal, etc., is washed with hot water, the filtrate is neutralised exactly, and evaporated to dryness. The residue is then ignited, and the resulting carbonates titrated. From the quantity of acid required for the titration, the amount of malic acid may be calculated, the quantity of succinic acid having been estimated previously by the method described by the authors in the preceding abstract.

W. P. S.

Estimation of Some of the Organic Acids Occurring in Fruits. GUNNER JÖRGENSEN (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 396—412).—The author has submitted the process described previously (Abstr., 1907, ii, 312) to further examination, and has introduced certain modifications in the manipulation. The separation of the citric and malic acids from one another is best carried out by taking advantage of the different solubilities of their barium salts in 26% alcohol; barium malate is fairly soluble in alcohol of this strength, whilst barium citrate is but slightly soluble. Results of estimations of organic acids in wines are given, the figures agreeing, on the whole, with those published previously. Citric acid does not appear to be a natural constituent of pure grape wines. The flesh of the common sloe (*Prunus communis*) was found to contain considerable quantities of malic acid, but tartaric and citric acids were absent. A small quantity of another acid, possibly succinic, was also present.

W. P. S.

Estimation of Calcium Citrate and of Lemon Juice. L. Gadais and J. Gadais (*Bull. Soc. chim.*, 1909, [iv], 5, 287—289).—Calcium citrate can be estimated by almost neutralising its solution in dilute hydrochloric acid with *N*-potassium hydroxide, adding a c.c. of saturated calcium chloride, and precipitating the calcium citrate by boiling; the precipitate is washed free from chloride, and the combined filtrate and washings are evaporated to about 15 c.c., whereby a second precipitate of calcium citrate is obtained. If necessary, the filtrate and washings are again concentrated and treated with alcohol to precipitate the last traces of calcium citrate. The combined precipitates are dried at 105° and ignited to the carbonate, which is dissolved in 30 c.c. of *N*-hydrochloric acid. After boiling to expel carbon dioxide, the excess of hydrochloric acid is titrated by *N*-potassium hydroxide.

Citric acid in lemon juice is estimated by diluting 120 c.c. to 1 litre; 25 c.c. are neutralised by *N*-potassium hydroxide, and 20 c.c. of saturated calcium chloride solution are added. The precipitation and estimation of the calcium citrate are then performed as above.

C. S.

Estimation of Uric Acid in Urine. A. Verda (*Chem. Zentr.*, 1909, i, 794; from *Schweiz. Woch. Chem. Pharm.*, 1909, 47, 6—9).—A slight modification of the iodine process recommended by Ruhemann (Abstr., 1902, ii, 435). In order to redissolve any uric acid which may have deposited, 50 c.c. of the sample are heated with addition of 1 gram of dry sodium acetate until a clear liquid has been obtained.

L. de K.

Estimation of the Relative Amounts of the Organic Acids Occurring in Tobacco before and after Fermentation. Julius Tóth (*Chem. Zeit.*, 1909, 33, 338—339).—A reply to Kissling's criticism (*ibid.*, 1908, 32, 717). The author upholds the accuracy of his process (Abstr., 1908, ii, 238, 330). An exhaustive table is given showing the effect of fermentation on the amount of dry matter and the volatile and non-volatile organic acids present in tobacco. They are represented respectively as oxalic and acetic acids. L. de K.

Estimation of Soil Acidity. Robert Albert (*Zeitsch. angew. Chem.*, 1909, 22, 533—537).—The soil (20—50 grams) is boiled with a known amount of magnesia, lime, or baryta, and an excess of an ammonium salt (200 c.c. of 5% ammonium sulphate), and the ammonia liberated absorbed by *N*/10-acid and estimated, using sodium alizarin-sulphonate as indicator. The difference in the amounts of ammonia liberated by the alkaline earth alone and with the soil represents the acidity of the soil.

Determinations of acidity in several soils by the new method and by Tacke's method (Süchting, Abstr., 1908, ii, 231) showed in most cases concordant results. In one case, however, a very much higher result was obtained than by Tacke's method. This was with a soil which is supposed to contain inorganic acid compounds (acid silicates : compare Kozai, this vol., ii, 87).

With regard to quantitative tests for soil acidity, Baumann and Gully (*Naturwiss. Zeitsch. Forst.-Landw.*, 1908, 1) have shown that Schütze's ammonia test is uncertain, as although absence of colour indicates absence of acid, a brown coloration does not necessarily indicate that acid is present.

Acidity may be detected and the amount approximately ascertained by adding lithium phosphate to a little soil (3 grams) suspended in water in a test-tube. The mixture is frequently shaken, and then left for some days until the colour ceases to become darker. The method of Baumann and Gully (*loc. cit.*) is also recommended. In this method the soil (3 grams) is added to a solution of potassium iodide (2 grams) and iodate (0·1 gram) in 100 c.c. of water. After being repeatedly shaken during fifteen minutes, the solution is filtered, and approximately equal amounts added to dilute starch solution. The two methods gave quite similar indications, according with the estimations by the process described above. N. H. J. M.

Modification of Halphen's Reaction. Léon Garnier (*J. Pharm. Chim.*, 1909, [vi], **29**, 273—274).—In applying Halphen's reaction for the detection of cotton seed oil in edible oils, the author uses carbon disulphide containing 2% of powdered sulphur in place of 1%, as generally recommended, and the liquid is employed with any undissolved sulphur in suspension. For quantitative purposes, comparison of the depth of colour obtained in any one case is made with a set of standard colours given by oils containing known quantities of cotton seed oil. T. A. H.

Colour Reaction of Fats. Ernest Schlumberger (*Bull. Soc. ind. Mulhouse*, 1909, **79**, 32—36).—When a concentrated aqueous solution of dextrose is added to a cooled mixture of equal parts of olive oil and sulphuric acid, and the preparation is then warmed to about 55° and stirred continuously, it becomes cherry-red in colour, then purple, and finally deep plum violet, or almost black, in thick layers. The coloration appears to be due to the action on oleic acid of furfuraldehyde formed by the action of sulphuric acid on the dextrose, and can be obtained by the direct action of furfuraldehyde on oleic acid in presence of sulphuric acid. Oils, such as castor oil, containing ricinoleic acid give a similar, but not identical, colour reaction.

T. A. H.

Saponifying Constituents of the Kola Nut. Willem P. H. van den Driessen Mareeuw (*Pharm. Weekblad*, 1909, **46**, 346—356).—Chiefly a review of the work of Mastbaum, the results of which are higher than those obtained by the author. This is attributed to a difference in the mode of drying the kola nut. A. J. W.

Detection of Acetone in Urine by Lieben's Test. W. Weitbrecht (*Chem. Zentr.*, 1909, i, 794; from *Schweiz. Woch. Chem. Pharm.*, 1909, **47**, 23—24).—A modification of Lieben's test (conversion into iodoform). The precipitate formed in the distillate is extracted with ether, and the latter is introduced into a flat dish in which is placed a strip of filter paper, which protrudes about 1 cm. over the sides of the dish and the ends of which have been torn, but not cut. When the ether has evaporated at the ordinary temperature, the iodoform remains on the paper, and may be identified with the aid of a magnifying glass, and also by its odour. L. de K.

Theory of the Colour Reactions of Dihydroxyacetone in Sulphuric Acid. Georges Denigès (*Compt. rend.*, 1909, **148**, 422—424. Compare this vol., ii, 272, 273).—The colour reactions previously studied in connexion with dihydroxyacetone have now been obtained with the oxidation products of polyhydric alcohols containing more carbon atoms than glycerol. The same reactions are readily given by methylglyoxal; hence the conclusion is drawn that the mechanism is analogous to that of Pettenkofer's reaction, an alcohol of the type $OH\cdot CH_2 \ldots\ldots CO\cdot CH_2\cdot OH$ undergoing dehydration by the sulphuric acid. The resulting aldehyde of the type $CH_3 \ldots\ldots CO\cdot CHO$ then condenses with the phenol or alkaloid (compare Ville and Derrien, *Compt. rend. Soc. Biol.*, 1909, **66**, 175). W. O. W.

Detection of "Saccharin" in Beer. Gunner Jörgensen (*Ann. Falsif.*, 1909, **2**, 58—59).—Five hundred c.c. of the sample are evaporated on the water-bath to syrupy consistence, and the residue is repeatedly extracted with strong alcohol. After recovering the bulk of the alcohol, the residue is diluted with water and heated on the water-bath until the alcohol has completely disappeared. When cold, the solution is acidified with dilute sulphuric acid, filtered if necessary, and repeatedly agitated with ether. The united ethereal extracts are concentrated to a small volume, and the residue is diluted with water, acidified with dilute sulphuric acid, and treated with a very slight excess of potassium permanganate, which is then again removed by cautious addition of oxalic acid. The "saccharin," now free from any salicylic acid, is recovered by shaking the filtrate with a mixture of ether and light petroleum, which is then evaporated to dryness. The residue is submitted to the well-known tests (conversion into salicylic acid, etc.). L. de K.

Detection of Glycine. Emil Abderhalden and Markus Guggenheim (*Zeitsch. physiol. Chem.*, 1909, **59**, 29—31).—Hirschstein (*Arch. exp. Path. Pharm.*, 1908, **59**, 401) states that treatment with potassium hydroxide (1 to 5%) destroys or alters glycine in such a way that it no longer can be detected with β-naphthalenesulphonyl chloride. The correctness of this statement is entirely denied.

W. D. H.

Estimation of Urea in Urine. Charles G. L. Wolf and Emil Osterberg (*J. Amer. Chem. Soc.*, 1909, **31**, 421—428).—Benedict and Gephart's method (this vol., ii, 103) for estimating urea in urine gives higher results than that of Folin (Abstr., 1901, ii, 630; 1903, ii, 116, 518). It has now been shown that in the former method, not only does the urea undergo quantitative decomposition, but also that ammonia is simultaneously produced from the uric acid and creatinine, thus giving rise to the high results. The method is therefore inaccurate. E. G.

Estimation of Ammonia and Urea in Urine. Paul E. Howe and Philip B. Hawk (*J. Biol. Chem.*, 1909, 5, 477—484).—Both Spiro's and Folin's methods for estimating urea and ammonia give good results with solutions of urea and of urea and ammonium chloride. But in urine, Spiro's method gives results which are higher by 6 to 10% than Folin's. This is because the nitrogen of the creatinine and hippuric acid and a portion of the uric acid nitrogen will be reckoned as urea nitrogen by Spiro's method. W. D. H.

Exact Gasometric Estimation of Urea and Urinary Ammonia. Albert Florence (*Compt. rend.*, 1909, 148, 943—946). —Analysis of samples of commercial urea shows that although the usual hypobromite method indicates only 92% of the theoretical amount, yet this corresponds with 97·5% when calculated on the actual amount of urea as indicated by the Kjeldahl method.

The ordinary gasometric method for estimating urea in urine has the disadvantage that the hypobromite attacks uric acid, creatinine, and ammonium salts with liberation of nitrogen. The following method, which avoids this source of error, is based on the observation that basic lead acetate removes uric acid and creatinine, and that, on heating, it decomposes the ammonium salts before attacking the urea. Ten c.c. of urine mixed with 5 c.c. officinal basic lead acetate solution are allowed to remain twenty to thirty minutes, and then filtered. The filtrate and washings are heated on the water-bath for about seventy minutes. The volume is made up to 100 c.c., and 19 c.c. withdrawn and treated in the ureometer with 12 c.c. of Moreigne's hypobromite solution. The ammonia is estimated by difference, by estimating the urea in a portion of the urine which has been defecated, but not heated with lead acetate.

A comparison is made, in a table, between results obtained in this way with results obtained by the Moerner process and the Moerner-Joquist method as modified by Braunstein. W. O. W.

Estimation of Thiocyanates with Permanganate. Hermann Grossmann and Lothar Hölter (*Chem. Zeit.*, 1909, 33, 348).—Thiocyanates cannot be estimated satisfactorily by titration with permanganate in acid solutions. Attempts to estimate the sulphate formed in the reaction both in acid and ammoniacal solution proved unsuccessful.

Bromine added to a solution of ammonium thiocyanate causes, however, a complete oxidation of the sulphur. L. de K.

Estimation of Caffeine in Coffee. K. Lendrich and E. Nottbohm (*Zeitsch. Nahr. Genussm.*, 1909, 17, 241—265).—The following method is proposed as the result of a considerable amount of experimental work, each part of the process having been submitted to a separate investigation. Twenty grams of the ground raw or roasted coffee are mixed with 10 c.c. of water and stirred occasionally for from one to two hours; the moist mass is then transferred to a cartridge or extraction thimble, and extracted for three hours with carbon tetrachloride. One gram of solid paraffin is added to the carbon tetrachloride solution, the solvent is distilled off, and the residue is extracted with four successive quantities of boiling water, using 50 c.c. the first time, and 25 c.c. for each of the following extractions. The aqueous solution is cooled, filtered through a moistened filter, and the residue is washed with hot water. The filtrate is treated, when cold, with from 10 to 30 c.c. of 1% potassium permanganate solution, and, after the lapse of fifteen minutes, the excess of permanganate is decomposed by the addition, drop by drop, of 3% hydrogen peroxide solution containing 1% of acetic acid. The whole is heated on a boiling water-bath for fifteen minutes, then filtered, and the residue washed with hot water. The filtrate and washings are evaporated to dryness, the residue is heated for fifteen minutes at a temperature of 100°, and extracted with chloroform. The chloroform solution is filtered, evaporated, and the residue of caffeine dried at 100° and weighed. The caffeine may be extracted directly with chloroform from the filtrate after the treatment with permanganate if this procedure is preferred. W. P. S.

Reaction to Differentiate α- from] β-Eucaine. G. Candussio (*Boll. chim. farm.*, 1909, 48, 95—96).—α-Eucaine is said to be distinguishable from the β-compound by the action of mercuric chloride solution, with which it gives a white precipitate. The author points out, however, that when the mercuric chloride is first added, the turbidity obtained disappears and is only permanent when excess of the reagent is present. The two compounds may be distinguished as follows. On adding to about 2 c.c. of a 1% solution of β-eucaine two drops of a solution of 1 gram of potassium iodide, 0·5 gram of iodine, and 10 c.c. of water, an intense reddish-brown coloration is formed immediately, and after one to two hours a slight, dark brown precipitate is deposited, the liquid itself becoming clear. Under similar treatment, a solution of α-eucaine gives at first an abundant reddish-brown precipitate, which in one to two hours becomes orange-coloured, the liquid having then a lemon-yellow colour owing to the presence of suspended precipitate. T. H. P.

Nicotine Silicotungstate and on the Estimation of Nicotine. Gabriel Bertrand and Maurice Javillier (*Bull. Soc. chim.*, 1909, [iv], 5, 241—248).—Since Schloesing's method for the estimation of nicotine, depending on the extraction of the alkaloid with ammoniacal ether and subsequent spontaneous evaporation of the solvent and titration of the residue with standard acid, gives untrustworthy results, due (1) to slight loss of alkaloid during evaporation of the solvent, (2) uncertain end titration point, and (3) simultaneous extraction of certain basic products along with the nicotine, the authors have devised a method of using silicotungstic acid, already suggested as an alkaloid reagent (Abstr., 1899, ii, 456), for the estimation of nicotine.

Nicotine silicotungstate, $12WO_3,SiO_2,2H_2O,2C_{10}H_{14}N_2+5H_2O$, obtained by adding potassium silicotungstate to nicotine tartrate dissolved in water slightly acidified with hydrochloric acid, is a pinkish-white salt, which becomes anhydrous at 120°, and is decomposed by alkalis or by magnesia. A precipitate of the salt is formed when a solution of potassium silicotungstate is added to one containing 1 part of nicotine in 300,000 of water acidified with 1 part of hydrochloric acid per 1000.

In estimating nicotine in tobacco, about 10 grams of leaf are ground and extracted successively four times with ten times its weight of 5% hydrochloric acid, each digestion occupying fifteen to twenty minutes on the water-bath. To the united liquors, potassium silicotungstate solution (10 to 20%) is added, the precipitate collected, washed, and placed in a distilling flask with water and magnesia. The nicotine thus liberated is distilled off, preferably in a current of steam, collected in water, and titrated with standard sulphuric acid. A number of results quoted in the original indicate that the process gives good results, and is more suitable for purely scientific work than that of Schloesing. T. A. H.

Colour Reactions of Indole Derivatives with Sugars. Julius Gnezda (*Compt. rend.*, 1909, **148**, 485—487).—Ten c.c. of a concentrated aqueous solution of glucose are boiled briskly and treated with two drops of sodium hydroxide solution and 6—10 mg. of 2-methylindole. When no more oily drops remain, the solution is allowed to remain for two minutes and then rapidly cooled. Two drops of fuming hydrogen chloride (D 1·19)* are added, and when the solution has become pale, 3 c.c. or a little more of the acid. The green precipitate obtained under these conditions consists of a mixture of two substances which have not yet been completely separated. No precipitate is obtained with sucrose, raffinose, inositol, or amygdalin.

The precipitate is in some cases of a different colour when the hydrogen chloride is added to a hot solution. Rhamnose, dextrose, galactose, lævulose, and lactose give green precipitates, both in hot and cold solutions. Xylose, arabinose, and ganbose give green precipitates in the cold and red precipitates in the hot solution.

Glucosoxime gives a red precipitate in each case. Mannose and maltose form green precipitates in the cold, but in hot solution the precipitates are brown and violet-grey respectively.

Under the same conditions, 1-methylindole gives an azure-blue precipitate with glucose in hot solution, and 3-methylindole, a brown coloration. W. O. W.

Detection of Albumin and Mercury in Urine. Carl Boening (*Chem. Zeit.*, 1909, **33**, 376—377).—The author has arrived at the following conclusions. When testing urine for mercury, the urine should not be filtered as the mercury may be contained in the deposit. If the usual tests for albumin fail, but if the deposit shows the presence of kidney cells, it is quite possible that the albumin has precipitated as an insoluble mercury compound. Hence, when testing

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* Misprinted as D 1·12 in original.—Author.

the urine of a patient undergoing mercurial treatment for albumin, the microscopical examination of the deposit should not be omitted.
L. de K.

Detection of Protein in Urine. G. Haswell Wilson (*J. Path. Bact.*, 1909, 13, 484—499).—The biological test (deviation of the complement) is from ten to one hundred times more sensitive than any chemical test for albuminous substances in urine; it cannot be obtained with normal urine; this property when present in disease is destroyed by boiling and unaffected by dialysis; it apparently resides in the albumin and globulin, and a mixture of these proteins obtained from the urine by salting out has a deviating power equal to that of the original urine.
W. D. H.

The Biuret and Nitric Acid Tests for Protein. Karl H. van Norman (*Bio.-Chem. J.*, 1909, 4, 127—135).—The delicacy of these reactions was studied especially from the point of view of detecting protein in the urine. The limit of delicacy of the nitric acid test is six parts of albumin in 10,000,000 parts of distilled water, or in 3,000,000 of urine. The limit of delicacy in the biuret reaction is four parts of albumin in 1,000,000 parts of water, or in 2000 of urine. Uric acid, urates, and creatinine interfere with the reaction. The intensity of the biuret reaction is increased by boiling.
W. D. H.

Abrastol. Ercole Covelli (*Boll. chim. farm.*, 1909, 48, 53—56).—The dark coloration obtained after precipitating a solution of abrastol with basic lead acetate, and boiling the filtrate with mercurous nitrate (Vitali, Abstr., 1908, ii, 642), is due to the reduction of a part of the mercury to the metallic state.

Abrastol is a sensitive reagent for the detection of nitrous acid, and conversely. When a drop of dilute nitrous acid is added to a solution of abrastol, and concentrated sulphuric acid then poured down the inclined wall of the test-tube, a ruby-red ring is produced. When *p*-phenylenediamine is added to a concentrated solution of abrastol, and then ferric chloride, a blue coloration, changing to red, is produced. In dilute solution, the red coloration only is obtained. A 1 : 150,000 solution of abrastol gives the coloration in five minutes.

An alkaline diazotised solution of atoxyl gives a red coloration with abrastol, the solution becoming fluorescent, owing to the action of the alkali.
C. H. D.

General and Physical Chemistry.

The Dispersion of Light in Gases. II. Ethylene and Ethane. Stanislas Loria (*Bull. Acad. Sci. Cracow*, 1909, 195—207.* Compare this vol., ii, 279).—Some small modifications have been made in the method previously employed. Ethylene, purified by fractional distillation at the temperature of liquid air, gives the values $a = 0{\cdot}0006303$ and $b = 1{\cdot}477 \times 10^{-10}$ for the constants in the equation $n - 1 = a(1 + b/\lambda^2)$.

Ethane, prepared by the Grignard reaction, gives the values $a = 0{\cdot}0007365$ and $b = 9{\cdot}308 \times 10^{-11}$. The results hitherto obtained for gaseous hydrocarbons are not in agreement with the requirements of the valency-electron theory. C. H. D.

Wave-length Tables of the Spectra of the Elements. Sir Henry E. Roscoe, Marshall Watts, Sir W. Norman Lockyer, Sir James Dewar, George D. Liveing, Arthur Schuster, W. Noel Hartley, Wolcott Gibbs, Sir William de W. Abney, and Walter E. Adeney (*Brit. Assoc. Report*, 1908, 119—201).—Wave-length tables of the arc and spark spectra of tantalum, zirconium, and lanthanum. T. H. P.

Wave-lengths of Lines in the Secondary Spectrum of Hydrogen. Herbert E. Watson (*Proc. Roy. Soc.*, 1909, **82**, *A*, 189—204).—Accurate measurements of the wave-lengths of lines in the secondary spectrum of hydrogen have been made, three primary hydrogen lines and the yellow and green mercury lines being used as standards. No lines could be detected on the less refrangible side of the *C*-line, but, on the other hand, a considerable number were measured the wave-lengths of which were less than $\lambda = 3646$, which is the theoretical limit of the primary spectrum according to Balmer's formula. Some of these very refrangible lines may, however, be due to the presence of water vapour. H. M. D.

Radiation and Temperature of the Flame of the Bunsen Burner. Edmond Bauer (*Compt. rend.*, 1909, **148**, 908—910).—By a method depending on the reversal of the *D*-ray, the mean temperature of the radiation from a Bunsen burner has been determined; the value obtained is 1750—1760°, in exact agreement with the result obtained by the emission method already described (this vol., ii, 106). By the same method, the temperature of different regions of the flame has been determined; the curve representing the results corresponds with those obtained by Schmidt, who measured with an optical pyrometer the temperature of a platinum wire immersed in the flame (*Inaug. Diss. Berlin*, 1909), except that the values of the latter observer are 50° lower throughout. The agreement of the two methods indicates that the temperature is the essential factor in the emission of line spectra by flames.

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* and *Ann. Physik*, 1909, [iv], **29**, 605—622.

Neither the absorptive and emissive power of a flame for the residual rays of fluor spar, nor its temperature is sensibly affected by rendering it luminous and a conductor of electricity. G. S.

Absorption of Ultra-violet Light by Dilute Solutions. F. B. Pidduck (*Phil. Mag.*, 1909, [vi], 17, 710—715).—The observation that the electrical action of ultra-violet light is diminished very much more by passing through tap-water than through distilled water has led the author to examine the absorptive power of dilute solutions. The dependence of the absorption on the concentration of the solution was investigated in the case of sodium chloride and potassium bromide. The latter salt is much more active than the former; the galvanometer deflexion after passing through 15 mm. of a 5×10^{-6} *N*-solution was only 0·91 of that obtained after passing through 15 mm. of distilled water. Observations on supply water and artificial water containing the same chief constituents are also recorded. H. M. D.

New Type of Magnetic Decomposition of Absorption Bands of Crystals. Simultaneous Production of Systems Circularly Polarised in Opposite Senses. Jean Becquerel (*Compt. rend.*, 1909, 148, 913—915).—Further examination of the plates representing the absorption spectra of crystals of tysonite at −253° (compare Becquerel and Onnes, Abstr., 1908, ii, 338) show that under the conditions in question one of the lines gives a quadruplet formed by two doublets polarised in opposite senses. Further observations at −193° with varying magnetic fields confirm these conclusions. Dufour (*Le Radium*, 1908, 5, 295), who has made somewhat similar observations on the emission spectra of certain chlorides and fluorides, ascribed them to incomplete polarisation of the light, but it is now shown that polarisation is complete. The observations are best interpreted on the assumption of the existence of positive electrons (compare Abstr., 1908, ii, 751). G. S.

Triboluminescence. Max Trautz (*Physikal. Zeitsch.*, 1909, 10, 255—258).—A claim for priority in respect of certain observations recorded by Gernez (this vol., ii, 108). Many of the discrepancies between the two series of observations are shown to be readily explainable. H. M. D.

Electro-chemistry of Light. VI. Wilder D. Bancroft (*J. Physical Chem.*, 1909, 13, 269—331. Compare this vol., ii, 362).—The author gives a third set of excerpts from papers dealing with solarisation. A lengthy summary of the conclusions which have been drawn by the various authors under review deals mainly with the nature of the latent photographic image and its reversal. R. J. C.

Calculations in Photochemical Processes. Alfred Byk (*Ber.*, 1909, 42, 1145—1149. Compare Abstr., 1908, ii, 338).—It is claimed that Weigert's treatment of the subject (this vol., ii, 219) is practically identical with that developed previously by the author. J. J. S.

Photochemistry of Silver (Sub-)halides. A. P. H. Trivelli (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 11, 730—748. Compare Abstr., 1908, ii, 1036).—The author is of the opinion that a series of sub-halides containing gradually decreasing proportions of halogen are formed in the photochemical decomposition of the silver halides. From observations of the colour changes which take place under different conditions, the colour sequence of the successive sub-halides has been found to be: green, bluish-green, blue, violet, red, orange, yellow. Since the order is the same for different halogens, the sub-halides of analogous composition appear to have analogous absorption spectra.

In the simplest case, the colours which appear may be referred to four corresponding with four sub-halides, which are supposed to be related in the following way:

$$Ag_{2n}X_{2n} \longrightarrow \underset{\alpha(\text{green})}{Ag_{2n}X_{2n-1}} \longrightarrow \underset{\beta(\text{blue})}{Ag_{2n}X_{2n-2}} \longrightarrow \underset{\gamma(\text{red})}{Ag_{2n}X_{2n-3}}$$

$$\longrightarrow \underset{\delta(\text{yellow})}{Ag_{2n}X_{2n-4}} \longrightarrow 2nAg.$$

If the δ-sub-halide is the final product, and corresponds with $Ag_{2n}X_n$, then n is equal to 4, and the formulæ of the four sub-halides may be written Ag_8X_7, Ag_8X_6, Ag_8X_5, and Ag_8X_4.

H. M. D.

Stability of the Colours of Minerals Produced by Radium. Cornelio Doelter (*Centr. Min.*, 1909, 232—234. Compare this vol., ii, 363).—The colours produced by subjecting various minerals to the action of radium rays are in many cases (sapphire, quartz, fluor spar) destroyed by heating the mineral at about 300°. Generally, the colour resulting from the action of radium is destroyed by ultra-violet light, more especially with fluor spar, rock salt, topaz, and sapphire. The colours produced by acting on natural rubies and emeralds with radium are very stable, but are nevertheless destroyed by ultra-violet light. Artificial rubies, likewise coloured diamonds, are not appreciably altered either by radium rays or ultra-violet light.

The periods of exposure necessary to produce the various colour changes differ largely with the various minerals. Fluor spar is extremely sensitive, whilst the several varieties of quartz change very slowly.

W. H. G.

Expulsion of Radioactive Matter in the Radium Transformations. Sidney Russ and Walter Makower (*Proc. Roy. Soc.*, 1909, 82, *A*, 205—224 *).—Experiments are described in which the authors have investigated the radiation effects which result from the recoil of the atomic residues when α- and β-particles are emitted from radium emanation and its products of disintegration. When the emanation is condensed at the bottom of an exhausted tube immersed in liquid air, active deposit particles are radiated up the tube. From the rate of decay of the activity which collects on a surface exposed to the radiation from the condensed emanation, it appears that both radium-*A* and -*B* are radiated. In air and hydrogen, the amount of the radiation which reaches a surface at a fixed distance from the condensed emanation is an exponential function of the gas pressure.

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* and *Physikal. Zeitsch.*, 1909, 10, 361—372.

A surface which has been rendered active by exposure to emanation is found to radiate both radium-*B* and radium-*C* through an exhausted tube. Since it is probable that the transformation of radium-*B* gives rise only to β-particles, the radiation of radium-*C* must be due to the recoil of the atoms resulting from the emission of electrons.

H. M. D.

Volatility of Radium-*A* and Radium-*C*. WALTER MAKOWER (*Mem. Manchester Phil. Soc.*, 1908–9, 53, (2), 1—8).—A nickel rod was exposed to a known quantity of radium emanation for ten minutes at a series of gradually increasing temperatures, the α-ray activity of the rod being examined after each exposure. At 885° the initial rapid fall in the α-ray activity was found to have nearly disappeared, and at 925° there was practically no evidence of the initial fall.

The observations indicate that radium-*A* begins to have an appreciable vapour pressure at 800°, and that at 900° it is completely volatilised.

In the investigation of the volatility of radium-*C*, the active deposit from radium was collected on plates of various materials by exposing them to emanation for several hours. After the lapse of sufficient time for the radium-*A* to have almost completely disappeared, the plates were heated for five minutes at various temperatures in a platinum-strip furnace, and the loss of activity determined. Experiments with platinum, nickel, and quartz plates indicate that the volatilisation of the radium-*C* is influenced by the nature of the material on which it is deposited. In all cases volatilisation begins between 700° and 800°, but whereas it is complete at 1200° when deposited on platinum or nickel, it is still incomplete at 1300° when deposited on quartz.

An experiment is described which shows that radium-*C* is not electrically charged when formed from radium-*B*. H. M. D.

Condensation of the Radium Emanation. ERNEST RUTHERFORD (*Phil. Mag.*, 1909, [vi], 17, 723—729. Compare this vol., ii, 202).—The temperatures at which radium emanation condenses under different pressures have been determined. The following results are recorded:

Temperature	−127°	−101°	−78°	−65°
Vapour pressure.........	0·9	5·0	25	76 cm. mercury

At the temperature of liquid air the volume of the liquid emanation corresponding with 100·mg. of radium was found to be not greater than $1 \cdot 2 \times 10^{-4}$ cubic mm. Assuming that the emanation is a monatomic gas of atomic weight 222, it is calculated from this that the density of liquid emanation is not less than 5. H. M. D.

Differences in the Decay of the Radium Emanation. ERNEST RUTHERFORD and Y. TUOMIKOSKI (*Mem. Manchester Phil. Soc.*, 1909, 53, (2) xii).—Measurements of the rate of decay of radium emanation have shown that this is often irregular, and depends to some extent on the treatment to which the emanation has been subjected. A sample, purified by condensation with liquid air, was found to decay for the first five days with an average period of 3·58 days; between five and twenty days the average period was 3·75 days, whilst between twenty and forty days the decay was nearly exponential with a period of 3·85 days. A second preparation was found to decay exponentially from the commencement with a period of 4·4 days. The samples of emanation which decay most rapidly are more easily absorbed by water and are more easily condensed by liquid air than the more slowly decaying fractions. The products of transformation of the emanation which decays slowly could not be distinguished from those of the rapidly decaying emanation. It appears probable that the physical and chemical properties of the emanation vary to some extent with the life of the emanation, and that the atoms undergo a progressive change in properties before disintegration.

H. M. D.

Direct Evidence of the Charge of the α-Rays. Heinrich Greinacher (*Ber. Deut. physikal. Ges.*, 1909, **11**, 179—184).—The experimental demonstration of the positive charge of the α-rays is rendered difficult by the fact that slowly-moving electrons are simultaneously emitted by radioactive substances. The method of demonstration described is similar to that which has been used to show the negative charge of the β-rays; the α-rays are allowed to fall on a thin, metal plate, which acts as receiver, and in order to prevent the escape of the charge, this plate is combined with a plate of solid, insulating material. H. M. D.

Leakage of Helium from Radioactive Minerals. Hon. Robert J. Strutt (*Proc. Roy. Soc.*, 1909, **82**, *A*, 166—169).—The fact that helium is not always present in larger quantity in geologically older minerals than in more recent formations of equal activity has been attributed to the escape of the gas. In connexion with this hypothesis, experiments have been made on the rate of leakage of helium from monazite and thorianite, which show that helium is given off at a rate which far exceeds the rate of production by radioactive change. The accumulation of the gas must be due to the fact that the conditions of existence of the minerals in nature are much more favourable to the retention of helium. H. M. D.

Absorption of Röntgen Rays. Charles G. Barkla and C. A. Sadler (*Phil. Mag.*, 1909, [vi], **17**, 739—760).—The authors have investigated the absorption of X-rays by various elements, using homogeneous beams of varying penetrating power. For soft rays the absorption coefficients of different elements remain in the same ratio when the penetrating power of the rays changes considerably. As the primary radiation is made more penetrating, a point is reached at which the absorbing element begins to emit homogeneous secondary rays which are characteristic of the element; at this point the absorption increases very rapidly to a maximum which corresponds with an absorption many times greater than that experienced by a somewhat less penetrating radiation; further increase in the hardness of the primary rays leads to a diminution in the absorption, and corresponding with this the secondary radiation decreases at the same rate as the ionisation produced by the primary radiation in a thin film of air. Of the various elements examined, chromium, iron, nickel, copper, zinc, platinum, gold, and arsenic were found to emit these characteristic homogeneous rays. No such radiation was observed in the case of carbon, magnesium, and aluminium. It is pointed out that the behaviour of nickel in all emission and absorption experiments corresponds with that of an element of atomic weight about 61·3.

H. M. D.

Conversion of Diamond into Coke in High Vacuum by Cathode Rays. A. A. Campbell Swinton (*Proc. Roy. Soc.*, 1909, 82, *A*, 176. Compare Abstr., 1908, ii, 275).—Spectrum tubes connected with a cathode-ray tube containing diamond, on which the cathode rays were focussed, were sealed off before and after the conversion of the diamond into coke. No difference could be detected in the two spectra except in regard to the relative brightness of certain lines. If gas is set free, it can therefore only be one or more of the comparatively common gases usually found as residuals in cathode-ray tubes exhausted from air in the ordinary way. H. M. D.

Radiation of Potassium Salts. E. Henriot (*Compt. rend.*, 1909, 148, 910—912. Compare Campbell and Wood, Abstr., 1907, ii, 217; McLennan and Kennedy, Abstr., 1908, ii, 750).—It is shown by absorption experiments with tin-foil that, contrary to the statements of previous observers, the radiation from potassium salts is fairly homogeneous; the absorption follows the formula $I=I_0e^{-\lambda d}$, where I is the intensity of the radiation which has traversed a thickness, d, of the absorbing substance, and I_0 is the initial intensity. The ratio λ/ρ, where λ is the coefficient of absorption and ρ the density of the tin, is 16, which is regarded as supporting the view that the radiation consists of β-rays.

The form of the radiation renders it improbable that the radioactivity of salts of potassium is due to a known active element.

G. S.

Distribution of Thorium in the Earth's Surface Materials. John Joly (*Phil. Mag.*, 1909, [vi], 17, 760—765).—A method for the detection of thorium in minerals is described. The material to be examined is brought into solution by the use of thorium-free reagents. The solution is boiled in a flask provided with a reflux condenser for twenty to thirty minutes in order to expel any accumulated radium emanation, and then a slow current of air is drawn through the flask in order to transfer the emanation to the electroscope. Arrangements are described for drying the air and reproducing the same velocity of air-flow in successive experiments. With three exceptions, all the rocks examined by the author were found to contain thorium. The results obtained with Vesuvian lavas accord well with Blanc's observations on the abundance of thorium emanation in the atmosphere at Rome. The quantities of thorium observed in some of these materials are about three times as large as the average uranium content of rocks. H. M. D.

Thermal and Ionising Action of Thorium in Rocks. GIAN A. BLANC (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 289—294).—The author has found previously (Abstr., 1908, ii, 248, 452; 1909, ii, 366) that a sample of soil in Rome contains at least $1{\cdot}45 \times 10^{-5}$ gram of thorium per gram, whilst 5 samples of granitic rock contained from 2·07 to $8{\cdot}28 \times 10^{-5}$ gram per gram. He now proceeds to consider the two following effects due to the presence of thorium: (1) the heat effect, produced principally by the transformation of kinetic energy accompanying the absorption of the α-particles in the interior of the rock and soil, and (2) the ionising action of the air, owing to the radiation directly emitted by the various products in the soil.

The above figures, together with Pegram and Webb's results (this vol., ii, 111), give the quantities of heat generated per hour in 1 gram of the soil and rocks examined, owing to the thorium present, as varying from 3·45 to $19{\cdot}70 \times 10^{-10}$ cals., the mean being $1{\cdot}01 \times 10^{-9}$ cals. This amount of heat is about double that produced by the uranium-radium-radium-*F* group in the igneous rocks examined by Strutt.

The mean proportion of thorium existing in the materials examined by the author being $4{\cdot}25 \times 10^{-5}$ gram per gram, and that of radium in the igneous rocks examined by Strutt being $3{\cdot}35 \times 10^{-12}$ gram per gram, the intensity of the γ-radiation emitted by the thorium in the former case will be 5·7 times as great as that of the γ-radiation due to the radium in the latter.

The method employed by Eve (Abstr., 1906, ii, 593) for deducing the quantity of radium contained in 1 c.c. of the soil at Montrea from the intensity of the penetrating radiation emitted by the soil, is inaccurate, since the observed effects are due to all the radioactive substances present emitting γ-rays. To this is probably due the discrepancy between the results obtained by Eve (*loc. cit.*) and those given by Eve and McIntosh (Abstr., 1907, ii, 729).

T. H. P.

Product and Rays of Uranium-*X*. FREDERICK SODDY (*Nature*, 1909, 79, 366—367; *Le Radium*, 1909, 6, 53).—The difference between the atomic weights indicates the expulsion of three α-particles in the change of uranium into radium, of which only two are known. Uranium-*X* preparations, after the decay of the β-activity, were found to possess a feeble residual α-radioactivity, which remains constant over a term of years. The constancy is attained before the β-radiation has decayed, so that if the α-ray substance is a true product of uranium-*X*, it must be the direct product. Some of the β-rays of uranium-*X* are very difficult to deviate by a magnetic field, and possess values for $H\rho$ as high as 6500, whilst with radium some rays with values as high as 9000 to 11,000 are present. The velocity of these rays must be more than 99% of that of light, and their mass from four to six times the normal mass. These facts have prevented so far the attempt to detect the growth of the feeble α-radiation during the decay of the β-radiation, to be expected if the α-ray substance is a product of uranium-X.

F. S.

Rays of Uranium-X. Frederick Soddy (*Nature*, 1909, 80, 37—38. Compare preceding abstract).—A second series of experiments has indicated the growth of the feeble α-radiation before referred to during the decay of the β-radiation of uranium-X. Fifty kilos. of uranyl nitrate were employed. The uranium-X immediately after preparation, when examined in a magnetic field such that no β-rays with value for $H\rho$ below 8640 could enter the electroscope, gave no α-rays. The leak in the electroscope was due, one-fourth to γ-rays, and three-fourths to still undeviated β-rays. In a few hours a feeble α-radiation made its appearance, and grew to a maximum in 2·5 days. It has since remained constant. The results are not yet capable of a complete interpretation, but indicate the existence of a new substance, presumably in the uranium-radium series, with a period of the order of one day, the product of which gives α-rays and has a very long period of life.

F. S.

γ-Rays of Uranium. Frederick Soddy and Alexander S. Russell (*Physikal. Zeitsch.*, 1909, 10, 249—251).—The authors have separated uranium-X from fifty kilograms of uranyl nitrate, and examined the γ-rays which it emits. The whole of the γ-radiation of uranium is emitted by uranium-X. The activity of this, as measured by the γ-rays, falls to half value in twenty-two days, which is identical with the half-decay period obtained by examination of the β-rays.

The absorption of the γ-rays by different substances was examined. The absorption in lead for thicknesses ranging from 1 to 5 cm. takes place according to an exponential equation, the value of the absorption-coefficient (λ) being 0·62. In general, the value of λ/d is equal to 0·055, whereas the corresponding ratio for the γ-rays of radium is 0·021. This means that the γ-rays of uranium are absorbed about two and a-half times as quickly as those of radium. Although 0·055 is the mean value of λ/d, the separate values vary from 0·045 (iron) to 0·068 (paraffin), and the exactness of the density law is questioned.

For greater thicknesses of absorbing material than correspond with 5 cm. of lead, the value of the absorption-coefficient diminishes, and there is some evidence of the existence of rays which are still more penetrating than the γ-rays.

H. M. D.

Conduction of Electricity in Electro-negative Vapours and A_1-Rays. Otto Reichenheim (*Ber. Deut. physikal. Ges.*, 1909, 11, 168—178).—Experiments on the discharge of electricity through exhausted tubes containing halogens and other metalloidal elements are described. The abnormally large fall of potential at the anode which characterises the discharge through such tubes is supposed to be due to the facility with which electrons are absorbed by the electro-negative vapours. In support of this view it is found that the potential drop at the anode is greatly diminished when electrons are generated in the discharge tube by means of a Wehnelt cathode.

When discharge takes place through a tube containing phosphorus vapour, the degree of exhaustion gradually increases, and this is found to be due to the deposition of the vapour in the form of red phosphorus on the walls of the tube. An experiment is described which indicates that the phosphorus vapour is negatively charged. The discharge through iodine vapour also leads to a gradual exhaustion of the tube; the degree of exhaustion diminishes if the tube is left for some hours. An explanation of this phenomenon has not been obtained.

A new type of radiation (A_1-rays) emitted by the anode is described. These are similar to the K_1-rays which Goldstein has found to be given off from the cathode. The A_1-rays are positively charged, and it is supposed that the rays are formed from negatively charged gaseous ions by the loss of two electrons. H. M. D.

Electrical Conductivities of very Dilute Solutions in Anhydrous Sulphur Dioxide. PAUL DUTOIT and ERNST GYR (*J. Chim. Phys.*, 1909, 7, 189—203).—Walden and Centnerszwer (Abstr., 1902, ii, 245) have found that the laws which hold for the conductivity of aqueous solutions are not applicable to solutions in liquid sulphur dioxide. The majority of organic solvents were formerly considered to behave similarly to sulphur dioxide, but Dutoit and his co-workers have shown that with very dilute solutions the same laws hold as for aqueous solutions, the only difference being in the dissociating power of the solvents. The authors have consequently further investigated the behaviour of liquid sulphur dioxide as a solvent.

A special apparatus was devised in which the solutions could be made and diluted to any strength without once coming into direct contact with the external atmosphere, all traces of moisture being rigorously excluded. The first experiments were made in red light in order to prevent any photochemical action which would result in the formation of sulphur trioxide, but it was found that white light had no effect on perfectly anhydrous sulphur dioxide. Moreover, under the same conditions, oxygen has no oxidising effect, even in the presence of the platinum electrodes. The specific conductivity of anhydrous sulphur dioxide at $-15°$ was found to be $0{\cdot}85 \times 10^{-7}$, which is the lowest value the authors have obtained for any solvent. The electrolytes used were tetramethylammonium iodide and bromide, and the iodides and bromides of ammonium, potassium, and rubidium; the dilutions varied from 125 to 64,000 litres. The results show that the molecular conductivity tends towards a maximum as the dilution increases, although this maximum is not attained at 64,000 litres. Graphic extrapolation and calculation by Ostwald's formula gave approximately the same numbers for the conductivity at infinite dilution; these numbers conform to Kohlrausch's law of the independent migration velocities of the ions. In the stronger solutions the salts of tetramethylammonium are much more strongly dissociated than those of the alkali metals, and the iodides more than the bromides. For dilutions of 8000 litres, Ostwald's dilution law holds approximately, the salts of rubidium giving the worst results.

T. S. P.

Temperature-coefficient of the Electrical Conductivity of Certain Acids and Bases in Aqueous Solution. A. Wörmann (*Ann. Physik*, 1909, [iv], 29, 194—200, 623—624).—The author has measured the conductivity of $1N$, $\frac{1}{2}N$, $\frac{1}{4}N$, $\frac{3}{8}N$, and $\frac{1}{10}N$ solutions of hydrochloric and nitric acids and of potassium and sodium hydroxides at 0°, 18°, and 32°. From the data, the values of the constants c and c' in the equation $K_t = K_0(1 + ct + c't^2)$ are calculated and compared with the coefficients given by other observers.

H. M. D.

Behaviour of Ethyl Ether on the Passage of an Electrical Current. Johannes Schröder (*Ann. Physik*, 1909, [iv], 29, 125—152).—The electrical conductivity of ethyl ether has been examined in detail with the object of throwing light on certain discrepancies which are exhibited by other feebly conducting liquids. The observed conductivity depends very largely on the previous treatment of the platinum electrodes. If the electrodes are charged with gases, the current increases with the applied *E.M.F.* more rapidly than corresponds with Ohm's law. The application of higher potential differences appears to favour the liberation of substances from the electrodes, which give rise to ions in the ethyl ether. With electrodes which have been heated to redness to remove volatile impurities, this effect is not observed, but the existence of a saturation current is indicated. When the current is passed in the same direction through the ethyl ether for a considerable time, the conductivity diminishes and approximates asymptotically to a lower limiting value.

H. M. D.

Oxidation Potentials in Non-aqueous Solvents. Richard Abegg and J. Neustadt (*Zeitsch. Elektrochem.*, 1909, 15, 264—266).—Nernst believes that oxidising and reducing agents react with the solvent-water, forming oxygen and hydrogen, which change the electrodes into gas electrodes of definite potential. The authors test this view by measuring the potentials of a platinum electrode in solutions of cuprous and cupric chlorides, and of ferrous and ferric chlorides, in pure dry pyridine; the potentials are measured against a silver electrode in a solution of silver nitrate in pyridine. The results show that the potentials in the pyridine solutions are nearly the same as those in aqueous solutions, from which the authors draw the conclusion that the potential of the electrode is due to the exchange of charges between the ions of different valency at its surface, the intervention of water being unessential.

T. E.

Electrolytic Potentials of Silver and Thallium. Francis J. Brislee (*Trans. Faraday Soc.*, 1909, 4, 159—165).—The potential of silver electrodes, freshly-silvered and measured against a $N/10$ calomel electrode, has the value + 1·076 volt in silver nitrate and + 1·074 volts in silver acetate solutions, the ionic concentration being calculated from the conductivity of the electrolyte. Thallium in thallous nitrate gives

– 0·042 volt, and in thallous chloride, – 0·042 volt. The values in thallous hydroxide increase with the dilution of the electrolyte, so an indirect method has been used, a thallium electrode in thallous nitrate being used for comparison, and the liquid potential difference being calculated by Planck's formula. This gives – 0·044 volt. C. H. D.

Part Played by Contact Electrification in the Permeability of Membranes to Electrolytes. PIERRE GIRARD (*Compt. rend.*, 1909, 148, 1047—1050).—It was shown (Abstr., 1908, ii, 456) that a membrane interposed in a liquid concentration couple lowers the voltage if the liquid in question is acidic or basic, but not if neutral. The membrane is considered as a bundle of capillary tubes, at the surfaces of which contact electrification takes place in the manner suggested by Perrin (Abstr., 1908, ii, 754). A difference of osmotic pressure on the two sides will establish a flow through the membrane, leaving an excess of positive and negative charges on either side. This is the same as a filtration *E.M.F.*, so that its value can be calculated with the aid of Helmholtz's theory. The agreement between calculated and experimental values is not very striking, however.

Acids and bases which diffuse in water more rapidly than neutral salts traverse a membrane more slowly, since, it is supposed, they electrify the membrane by contact. If a salt solution diffusing through a membrane into water is rendered slightly acidic or alkaline, the membrane becomes polarised, and diffusion is promoted or hindered, according to the direction of the *E.M.F.* set up. Thus the amount of magnesium chloride passing in thirty minutes from a normal solution into water across a film of gelatin was found to be 0·0012 gram; if the solution was acidified with a little $N/100$ HCl, only 0·00035 gram passed, but in presence of a trace of soda the amount passing was almost 0·0024 gram. This effect might be reversed in the case of another salt, hence a membrane electrified by contact might exhibit selective permeability to salts. The protoplasmic interior of a living cell is never neutral, and polarisation must be set up at the membrane constituting the cell wall. The author claims that it may legitimately be supposed that this polarisation is the origin of selective permeability in living membranes. R. J. C.

Oxide Theory of the Oxygen Electrode. III. RICHARD LORENZ and E. LAUBER (*Zeitsch. Elektrochem.*, 1909, 15, 206—212. Compare this vol., ii, 15, 371).—The arrests in the discharge curve of a polarised cadmium anode in normal potassium hydroxide are at about 1·7, 1·1, 0·64, 0·35, 0·17, 0·07, and 0·03 volt.

In the experiments with platinum, the cathode was a platinised platinum sheet kept in a current of hydrogen; the electrolyte was sulphuric acid of maximum conductivity. The anode was comparatively easily formed. A platinised anode gives discharge curves with indistinct rounded arrests, whilst a smooth anode gives curves with sharp arrests. If the cathode is too small, the discharge curves are parallel to each other, their relative height depending on the time and strength of current used in charging. By using suitable current densities in charging, certain arrests can be developed and others suppressed. The arrests observed are at 1·95, 1·65, 1·3, 1·05, 0·97 ?, 0·94, 0·74, 0·64, 0·57, 0·43, 0·27, 0·12, 0·05, and 0·008 volt. Many of these can be identified with the potentials of known oxides or hydroxides of platinum.

T. E.

Action of Continuous Current on Symmetrical Chains of Aqueous Solutions of Electrolytes which have no Common Ion. M. Chanoz (*Compt. rend.*, 1909, 148, 986—988. Compare this vol., ii, 292).—The potential differences set up at the liquid interfaces when a current is passed through a series of solutions of electrolytes, MR | M′R′ | MR, are due, not only to local differences in concentration of M′R′, but also to the formation of new salts MR′ and M′R at the respective surfaces. The potential differences are not necessarily of opposite sign, as would be the case if concentration alone were concerned, for the effect of the new salts produced may be the main factor, and the potential differences may even change in sign with prolonged passage of the current.

By employing coloured salts, such as cupric sulphate or potassium permanganate, the changes in concentration induced by a current may be observed. The formation of the new salts MR′ and M′R may also be observed if these are insoluble substances, such as AgCl or $Cu(OH)_2$.

R. J. C.

Electrolysis of Acids and Bases. Umberto Cialdea (*Nuovo Cim.*, 1909, [v], 17, 66—68).—The increase of concentration of dilute sulphuric acid at the anode and the diminution at the cathode after a current has been passed can be readily shown by means of the following apparatus. Two platinum wires, passing nearly to the bottom of the two limbs of a U-tube containing the acid, are connected through a galvanometer, sensitive to 0·001 ampere, to a continuous current generator having P.D. 50—100 volts. When the circuit is closed, the current remains constant for some time, but later falls gradually to zero. It will now be found that the cathode liquid does not give an acid reaction. Addition of a drop of acid to the anode limb of the U-tube now causes no change, but, if added to the cathode limb, the current will speedily begin to pass again. Similar results are obtained with sodium or potassium hydroxide solution, the anode liquid becoming free from the base. Complete separation of the anodic from the cathodic liquid may be effected by placing one of the electrodes in a tube closed at the bottom by means of a porous diaphragm, the tube being filled with the solution and immersed in a beaker filled with the same solution, into which the other electrode dips. When the current drops to zero, the tube is removed.

T. H. P.

Apparatus to Demonstrate the Different Velocities of Displacement of Electrolytic Ions. Umberto Cialdea (*Nuovo Cim.*, 1909, [v], 17, 69—70).—This apparatus resembles that devised by Loeb and Nernst for the determination of Hittorf's transport numbers, but has no tap in either of the side-tubes. A solution of, for example, zinc chloride is electrolysed so that the Zn-ions arriving at the cathode find there chlorine with which to re-form zinc chloride, whilst the Cl-ions similarly find zinc at the anode. This is effected by using a spiral of zinc wire as anode and a spiral of silver wire coated with fused silver chloride as cathode. As the velocities of the zinc and chlorine ions differ considerably, about ten to twenty minutes after closing the circuit a concentration cell is formed, as may be seen by connecting two auxiliary electrodes (of platinum wire, the end of which is covered with a thin layer of zinc or of zinc amalgam), one in each limb, through a galvanometer or electrometer sensitive to 0·001 volt. From the sense of the *E.M.F.*, it is seen that the greater concentration of zinc chloride is at the anode. Diffusion in the electrolyte may be avoided by suspending the apparatus in a thermostat, and by using very small currents of 10—50 milliamperes. T. H. P.

Electrical Charge of Colloidal Silver. William C. McC. Lewis (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 209—211).—The author doubts the validity of Burton's method (Abstr., 1906, ii, 841) of deducing the charge on the particles of colloidal metals. Whereas Burton assumed that the whole of the added electrolyte takes part directly in the neutralisation of the charge on the colloidal particles, the author considers that an equilibrium condition is set up which is determined by the concentration of the adsorbed ions and of the ions in the aqueous solution. H. M. D.

Specific Heats of Air and Carbon Dioxide at Atmospheric Pressure by the Continuous Electrical Method at 20° and 100°. W. F. G. Swann (*Proc. Roy. Soc.*, 1909, 82, *A*, 147—149).—A steady stream of the gas was passed through a jacketed tube, in which it was heated by a current of electricity passing through a platinum coil, the rise in temperature being measured by means of two platinum resistance thermometers used differentially. By means of a second experiment, in which the rate of flow of the gas was about half that in the first experiment, and in which the current was adjusted so that the rise in temperature was the same as before, the loss of heat due to radiation and other causes could be eliminated.

The specific heat of air was found to be 0·24173 at 20° and 0·24301 at 100°, and that of carbon dioxide, 0·20202 at 20° and 0·22121 at 100°. The separate determinations agreed in each case to about 1·5 parts in 1000, and it is estimated that the mean results are probably correct to 1 part in 1000. H. M. D.

Specific Heats of Non-metals: Sulphur. W. A. Kurbatoff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 311—312).—The author has re-determined the specific heat of rhombic sulphur by means of the bomb-calorimeter, pieces of sulphur 1·5—2 mm. in diameter being employed in order to avoid a too retarded transference of heat to the calorimeter; the highest temperature employed was below that at which rhombic sulphur changes into the monoclinic form. The mean specific heat between 23° and 92° was found to be 0·1759, the greatest variation from this value being 5%. This low degree of accuracy is caused by the necessity of (1) using a short range of temperature, and

(2) placing the sulphur in water which has a high specific heat, every other substance dissolving sulphur to some extent.

There is no doubt but that the atomic heats of sulphur and phosphorus (*ibid.*, 1907, **39**, 1181) at corresponding temperatures are lower than those of the metals, and the conclusion is drawn that the molecules of these two non-metals in the crystalline state are more complex than those of metals. T. H. P.

Slowness of the Spontaneous Transformation of the Unstable Variety of Certain Dimorphous Substances at Low Temperatures. Désiré Gernez (*Compt. rend.*, 1909, **148**, 1015—1019 *).—Both dimorphous forms of sulphur (transition point, 97·6°) can exist in the metastable state. Orthorhombic sulphur may be heated above 97·6°, and monoclinic sulphur, if cooled to a point much below this, persists for a very long time. The same peculiarity is particularly noticeable in mercuric iodide and thallous iodide.

Mercuric iodide sublimed in a vacuum on to a water-cooled tube always appears in the yellow form, although the red variety is stable at the temperature employed. The yellow sublimate alters but very slowly, each red crystal serving as a nucleus for the propagation of the change. The stability of the yellow form depends largely on the care exercised in excluding red particles from the sublimate. Even after ten years, isolated patches of yellow crystals could be seen. Thallous iodide (transition point, 168°) exhibits the same property, the unstable red variety having persisted at the ordinary temperature for nine years.

Yellow mercuric iodide, obtained by rapid evaporation of its solutions, may be kept unchanged for a very long time if dust is excluded.

R. J. C.

Freezing-point and Boiling-point Curves in a Binary System. W. P. A. Jonker (*Zeitsch. physikal. Chem.*, 1909, **66**, 300—306).—Bakhius Roozeboom (*Heterogene Gleichgewichte II*, 328) has deduced the changes occurring in the freezing-point and boiling-point curves of a binary system when one or both components is volatile. The author has obtained the same results by a simple graphic method, depending on the relative displacement of the chief points on the diagram. G. S.

Determination of the Density of Small Quantities of Liquids. H. von Wartenberg (*Ber.*, 1909, **42**, 1126—1131).—The density of a liquid, of which only a small quantity is available, can be determined by sucking the liquid into a minute pipette, of a few tenths cm. capacity, which is suspended horizontally from the arm of Nernst's micro-balance (Abstr., 1903, ii, 571), by which the weight is ascertained. C. S.

Physico-chemical Constants of Some Gases. Philippe A. Guye (*Bull. Soc. chim.*, 1909, [iv], **5**, 339—340).—A brief summary of the values obtained by the author and his colleagues for the densities, critical constants, and coefficients of compressibility of certain gases compare Abstr., 1904, ii, 612, 812; 1905, ii, 506; 1906, ii, 20; 1907, ii, 80; 1908, ii, 372, 940); the following constants have not been recorded previously:

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* and *Ann. Chim. Phys.*, 1909, [viii], **17**, 290—296.

Weight of a litre of gas under reduced pressure at 0°.

Gas.	Pressure.	Density.	Gas.	Pressure.	Density.
SO_2......	570·0 mm.	2·1789	OMe_2...	501·37 mm.	1·3790
	518·2 ,,	1·9802		379·40 ,,	1·0391
	380·0 ,,	1·4456	MeCl ...	547·40 ,,	1·6495
	311·3 ,,	1·1820		341·45 ,,	1·0228

Critical Constants.

Gas.	Critical temperature.	Critical pressure.
NH_3	+132·3°	109·6 atmos.
SO_2	157·2	78·0 ,,
HCl	51·8	83·6 ,,
PH_3	51·3	64·5 ,,
OMe_2...............	127·1	53·0 ,,
MeCl...............	143·2	65·85 ,,

Coefficients of Compressibility at 0°.

	Coefficient of compressibility measured directly under		
Gas.	40—80 cm. Hg.	20—40 cm. Hg.	0—1 atmos.
H_2	−0·0000069	—	−0·00052
He	−0·0000079	—	−0·00060
O_2	+0·0000127	—	+0·00097
NO	+0·0000154	—	+0·00117
NH_3	+0·0002008	+0·0001997	+0·01521
SO_2	+0·0003137	+0·0003105	+0·02379

The following coefficients of compressibility calculated from densities under 7—1 atmos.: SO_2, +0·02381; OMe_2, +0·02656; MeCl, +0·02215.

M. A. W.

Cohesive and Electrical Forces. Contact Electricity. Isidor Traube (*Ber.*, 1909, 42, 1594—1602).—In continuation of the relations shown to hold between the internal pressure of the metals, deduced from a modified van der Waals' equation, and their physical properties, it is now shown that the order of the coefficients of thermal expansion, 3β, and of the heats of volatilisation, a/v, which are inversely proportional to them, is approximately parallel with the electrical potential series. There is, however, an exact correspondence between the latter and the order of the magnitude, $a/v^{2/3}$. Since $a/v =$ the surface energy $\gamma v^{2/3}$, $a/v^{2/3} = \gamma v$, that is, a magnitude which may be regarded as the attraction which a sq. cm. of surface experiences from the inner side. The potential difference of two metals in contact is then proportional to their difference of surface tension. This is confirmed by the effect of small quantities of impurities on the metals, internal pressure and electrolytic potential being similarly affected. The effect of mechanical hardening on potential is also in accordance with this relation. The effect of the surface-tension of the electrolyte is also discussed.

The behaviour of an electrode is determined by the equality or inequality of a/v and Q, the heat of formation. If $a/v > Q$, as for the noble metals, there is no positive solution pressure, and the metal tends to fall out from solution. With most metals, $a/v < Q$.

C. H. D.

Dissociation of Water Vapour. ALFRED HOLT, jun. (*Phil. Mag.*, 1909, [vi], 17, 715—723).—The discrepancy between the values obtained for the degree of dissociation of water vapour at temperatures above 1300° by the author (Abstr., 1907, ii, 450) and those obtained by Nernst and Wartenberg (Abstr., 1906, ii, 729) and by Langmuir (*ibid.*, ii, 848) has been traced to the fact that the estimated temperatures used in the author's experiments were much higher than the true temperatures. When the corrected temperature values are used, the author's data agree satisfactorily with those of the other experimenters.

New measurements are recorded with a somewhat improved form of apparatus for temperatures ranging from 1233° to 1637°. From these data, the value of the equilibrium constant K in the thermodynamic equation of Nernst and Wartenberg is found to be 3·806. When the data of other investigators are taken into consideration, the most probable mean value obtained for the constant is 3·80.

H. M. D.

The Dissociation of Sulphuric Acid and of Nitrogen Dioxide. MAX BODENSTEIN and MASSAO KATAYAMA (*Zeitsch. Elektrochem.*, 1909, 15, 244—249).—Sulphuric acid (85 to 100% of H_2SO_4) or nitrogen peroxide are weighed into a vacuous quartz-glass bulb to which a quartz-glass manometer, constructed on the principle of the Bourdon gauge, is sealed. The whole is heated in an electric furnace, and the degree of dissociation calculated from the pressure. The quartz glass manometer begins to undergo permanent deformation at temperatures above 600°, but if it is enclosed in a vessel in which the pressure is kept equal to that in the inside of the spiral, so that the pointer remains at the zero of the scale, it may be used for temperatures above 700°. The values of the dissociation constants for sulphuric acid, $\log K = \log[SO_3][H_2O]/[H_2SO_4]$, are calculated by means of Nernst's thermodynamic theorem. The simplified form gives $\log K = -Q/4{\cdot}571T + 0{\cdot}75 \log T + 4{\cdot}086$ (concentrations taken in gram-molecules per litre). The temperature of half dissociation at atmospheric pressure calculated from this equation is 599° absolute, whilst the experiments give 623°; by adding cT to the equation to allow for the difference of specific heat of the substance formed and destroyed in the change, the equation becomes

$$\log K = -22850/4{\cdot}571T + 0{\cdot}75 \log T - 0{\cdot}00057T + 4{\cdot}086,$$

and this reproduces the experimental results very exactly.

The dissociation constants for nitrogen dioxide between 200° and 700°, $\log K = \log[NO]^2[O_2]/[NO_2]^2$, are represented very well indeed by the simple expression $\log K = -Q/4{\cdot}571T + 0{\cdot}75T + 4{\cdot}086$, where $Q = +27{,}400$ cals., which is the value found by direct calorimetric experiments.

T. E.

Adsorption of Sugars by Animal Charcoal. Reginald O. Herzog and J. Adler (*Zeitsch. physiol. Chem.*, 1909, 60, 79—84. Compare Rona and Michaelis (this vol., ii, 384).—The adsorption of dextrose by animal charcoal has reached its maximum at the end of thirty minutes, and in the presence of air is not accompanied by any appreciable oxidation.

Experiments made with different sugars, and using 100 c.c. of solutions of varying concentrations and 5 grams of charcoal, show that $C = KB^n$, where C represents the sugar adsorbed by the charcoal, B the amount left in solution, and K and n are constants which vary with the different sugars:

	n.	K.
Dextrose	0·474	0·766
Lævulose	0·539	0·338
Galactose	0·694	1·016
Sucrose...........	0·127	0·106
Maltose	0·133	1·142
Milk sugar	0·135	1·138

Experiments were also made by varying the amount of charcoal.

J. J. S.

Adsorption with Special Reference to the Ascent of Salt Solutions in Filter Paper. Rudolf Krulla (*Zeitsch. physikal. Chem.*, 1909, 66, 307—348).—The method of experiment was as follows: A beaker 13 cm. high and 6 cm. in diameter contained 50 c.c. of a salt solution, and was covered by a piece of paste board in which were three slits, each 1 cm. long. Through these slits pass strips of filter paper which dip in the solution, and the height to which the different salts rise for the same height of water is determined. In order to investigate the distribution of the salt in the strips of paper, the latter are removed from the solution, rapidly dried, dipped in the solution of a substance which reacts with the salt (colour reaction), and again rapidly dried. In some cases investigations were made with the same time of immersion, instead of comparing equal heights of ascent of water.

On the basis of experiments, chiefly with solutions of lead nitrate and of copper sulphate, the following comparative formula for adsorption under the conditions of the experiment is deduced: $e\alpha hp'H'/e'\alpha'h'pH = 0{\cdot}835\,p'/p + 0{\cdot}167$, where h and h' represent the respective heights of the salts, H and H' those of the water in the two cases, p and p' the percentage strengths of the solutions, e and e' are expressions for the relative absorptive powers of the papers, and α and α' are the limiting values for the adsorption of the salts at zero concentration. For the same paper and the same height of water (the usual experimental conditions) the formula becomes simplified in an obvious way.

When all the factors but one are known, the formula can be used for various purposes, for example, to find the relative degree of adsorption of filter paper for salts ($\alpha : \alpha'$), or to determine the strength of a solution (p' when α' is known). The values of α', compared with lead nitrate as unity, are given in tabular form for a number of salts; the values are in all cases less than unity.

Some experiments on adsorption from mixed salt solutions are described. When the salts have a common ion, the degree of adsorption for the components separately is smaller than when the salts are present alone in the same proportion, but if the ions are different there is no reciprocal influence. Highly ionised salts are often adsorbed to a much smaller extent than those only slightly ionised. In explanation of this observation, it is assumed that at the surface of contact water–amorphous substance the adsorbed salt is completely ionised, and the greater the concentration of the dissociation products in the solution the more of the salt is adsorbed. The fact that solutions of neutral salts often become acid or alkaline in the presence of an absorber is due to the different affinity of the latter for the two ions.

The application of the method to qualitative and quantitative analysis is briefly considered. A bibliography of the subject is given.

G. S.

Capillary Constants and Molecular Weights. PAUL DUTOIT and PIERRE MOJOÏU (*J. Chim. Phys.*, 1909, 7, 169—188).—Although the method of Ramsay and Shields is generally considered to be the best for determining the molecular weight of a liquid, the work which has been carried out by Guye has shown that the temperature-coefficient (K) of the molecular surface energy often possesses values greater than 2·12; in the case of liquids which have a large molecular volume and a high boiling point, K may even attain the value 3. If Ramsay and Shields' method is considered an exact one, it would be necessary to make the improbable assumption that such liquids are dissociated. The authors put forward a formula connecting the molecular weight (M), vapour pressure (p), and specific cohesion (a^2) which may be used to determine molecular weights, and show that it gives more satisfactory results than Ramsay and Shields' formula.

From a consideration of the relations between the latent heat of evaporation (L), density, thickness of the superficial layer, and specific cohesion of a non-associated liquid, it is shown that L is proportional to a^2. The values obtained for L/a^2 at the boiling point under a pressure of one atmosphere for eleven different liquids are found to be approximately constant, varying only from 0·0173 to 0·0188, whereas for the same liquids the values of $ML/\gamma(Mv)^{\frac{2}{3}}$ vary from 0·0163 to 0·0205. This same relation may be deduced by a combination of the rules of Trouton ($ML/T =$ const.) and Kistiakowsky ($Ma^2/T =$ const.).

The empirical relation $M = \dfrac{0{\cdot}6\,T(4{\cdot}8 - \log p)}{a^2}$, where T is the absolute boiling point under a pressure p, is found to give remarkably good results for pressures up to 1500 mm. Using the results for T, p, and a^2 obtained by other observers, the molecular weights for chlorobenzene, dimethylaniline, ethylene dibromide, benzene, carbon tetrachloride, and quinoline were found to be within 2% of the theoretical.

The authors then describe a simple apparatus by means of which the values of p and a^2 at any particular temperature up to 200° can be readily and simultaneously determined, and give results which they have obtained for twenty two non-associated liquids. Liquids such as anisole, dimethylaniline, etc., which are dissociated according to

Ramsay and Shields, gave normal results, whilst, on the other hand, pyridine, nitrobenzene, aniline, and benzonitrile were found to be slightly associated at the ordinary temperature, whereas according to Ramsay and Shields they are normal, or else slightly dissociated. Experiments on the associated liquids, water and ethyl alcohol, gave association factors which lie between those found by Ramsay and Shields and Ramsay and Rose-Innes.

In an appendix it is claimed that this research is independent of that of Walden (Abstr., 1909, ii, 119, 122), and, moreover, that it is simpler and gives better results. T. S P.

Rate of Evolution and Absorption of Carbon Dioxide by Water. Julius Meyer (*Zeitsch. Elektrochem.*, 1909, 15, 249—252).—The surface of a gas bubble in a solution is bounded by a liquid capillary film, in which the concentration of the dissolved substance is different from that in the main bulk of the solution. It is quite analogous to the liquid film which adheres to the surface of a solid immersed in a liquid. Reactions between a gas and a liquid may therefore be treated in the same way as reactions between solids and liquids. The simple case of a series of air bubbles passing through an aqueous solution of carbon dioxide gives the rate of loss of carbon dioxide: $dx/dt = k.(c-x)$, an expression which agrees well with Knox's experiments (*Ann. Phys. Chem.*, 1889, [ii], 54, 44). A similar expression applies to the absorption of carbon dioxide, but the experimental results do not agree very well with it. T. E.

Method of Demonstrating the Phenomenon of Dialysis in a Very Short Time. Umberto Cialdea (*Nuovo Cim.*, 1909, [v], 17, 71—72).—This method makes use of a dialyser containing distilled water in both the inner and outer vessels, into each of which dip two electrodes, consisting of glass tubes with pieces of platinum sealed into the ends and containing a little mercury. The inner and outer liquids are arranged in two different circuits, each of which contains a telephone, and both of which are served by the same induction coil or town mains. When the dialyser contains only water, the telephones show no current, and the same is the case when a colloid, such as ferric hydroxide, is introduced into the inner vessel. But when a few drops of saturated sodium or lithium chloride solution are added, the telephone of the inner vessel circuit sounds immediately, and the other in a few minutes time. It can be shown subsequently that the sodium or lithium chloride has diffused into the outer vessel, but that the colloid remains in the inner one. T. H. P.

Mathematical Investigation of the Relationships Occurring in the Equilibrium of Binary Mixtures in Solution and in Vapour. Willy Bein (*Zeitsch. physikal. Chem.*, 1909, 66, 257—274).—The three binary systems, benzene–ethylene chloride, benzene–carbon tetrachloride, and acetone–chloroform, are dealt with in greater mathematical detail on the lines of Dolezalek's recent paper (this vol., ii, 22), and the conclusions arrived at are in substantial agreement with those already given. For the last two systems, different expressions are obtained for the respective equilibrium constants in terms of n, $\rho = p/p_0$, and $\sigma = \pi/\pi_0$ (Dolezalek, *loc. cit.*), and corrections are applied which bring into agreement the values of the respective constants obtained by the different expressions. From the values of the corrections, the equilibria in the solutions can then be calculated. In the system acetone–chloroform, the compound present in the liquid phase also exists to some extent in the vapour. G. S.

Three-phase Equilibrium (with a Pressure Minimum) of a Dissociating Compound of Two Components. II. Gerard H. Leopold (*Zeitsch. physikal. Chem.*, 1909. 66, 357—380. Compare this vol., ii, 218).—The complete equilibrium between chloral alcoholate and its components has been investigated. The compound was prepared by mixing chloral and ethyl alcohol in equivalent proportions; it was crystallised from light petroleum, and the last traces of the latter removed by sublimation under reduced pressure.

The true melting point of the compound (the temperature at which crystals of the alcoholate are stable in contact with the fused mass) is 46·6°, but on heating rapidly it only melts at about 55°, owing to the slow attainment of equilibrium. The curve falls steeply on both sides from the melting point, showing that the compound is only slightly dissociated. The eutectic point on the chloral side lies very near 100% of the latter.

The boiling point of the compound is 116·8°/771 mm.; the mixture of maximum boiling point contains 50·5 mol. % of chloral.

The vapour pressure of the alcoholate itself, as well as those of its saturated solutions in alcohol and chloral, have been determined at different temperatures by a tensimeter. The maximum sublimation point coincides with the melting point, 46·6°, within the limits of experimental error, the pressure at this point being 17·5 mm.; the compound, therefore, behaves like a non-dissociated substance. As the fused compound can readily be supercooled, it was found possible to determine a part of the metastable curve liquid–gas, which is throughout above the sublimation curve, in accordance with theory.

The curve of vapour pressure of saturated solutions of the alcoholate in chloral shows a maximum at 41°, the pressure being 19·8 mm.; but the existence of a minimum could not be determined experimentally, as it lies so near the melting point. The vapour-pressure curve of saturated solutions of the alcoholate in alcohol has a maximum at 38°, the pressure being 22·1 mm. It is shown that certain anomalies in the results obtained by Ramsay and Young (Trans., 1886, 49, 685) for this system are due to the fact that their alcoholate was contaminated with alcohol, so that they measured a section of a three phase curve instead of a sublimation curve. G. S.

Critical Solution Phenomena and Saturation Curves of the System: Water, Pyridine, and Sodium Carbonate. H. Lambosch (*Bull. Soc. chim. Belg.*, 1909, 23, 179—200).—The author has examined in detail the influence of varying quantities of sodium carbonate on the miscibility of pyridine and water. The observations, which extend from −65° to about 200°, are diagrammatically presented so as to show the relationship between the various saturation curves. H. M. D.

The Nature of Liquid ("Flüssige" and "Fliessende") Crystals. Georg Wulff (*Zeitsch. Kryst. Min.*, 1909, 46, 261—265).—From observations of drops and thin layers under the microscope, the author concludes that the liquid (flüssige) crystals of *p*-azoxyphenetole have a cellular, frothy structure, consisting of a solid skin of birefringent material filled with an isotropic liquid. On the other hand, the "fliessende" crystals of ethyl *p*-azoxybenzoate consist of minute platy crystals with like orientation in a liquid envelope.

L. J. S.

Colloid Chemistry. Henry R. Procter (*Brit. Assoc. Report*, 1908, 201—221).—A résumé of our knowledge of the chemistry of colloids. T. H. P.

Physico-chemical Properties of the Colloidal Particles or Granules. G. Malfitano (*Compt. rend.*, 1909, 148, 1045—1047. Compare Abstr., 1906, ii, 647).—The author combats generally the theoretical views put forward by Duclaux (this vol., ii, 303). Freshly prepared ferric chloride solutions pass completely through collodion filters, but hydrolysis occurs when kept, and a certain proportion of the iron and chlorine enter into the colloidal state. The ratio Fe : Cl in the colloid is not an integral atomic one, but varies with the proportions of the two ions in the crystalloid liquid between the particles. If the colloidal particles are separated by the filter and suspended in water, a redistribution of the chlorine occurs, whereby the ratio of iron to chlorine in the colloid is increased. Since the colloid is a variable system, it cannot be said to be purer after washing with water, as Duclaux supposed (Abstr., 1906, ii, 677).

The conductivity of a colloid solution may be moro or less than the conductivity of its filtered intergranular liquid, and although colloid particles doubtless have some conducting power when suspended in an electrolyte, the phenomena are too complicated to lead to a value of their separate conductivity. Colloidal particles are supposed to be double compounds, each insoluble molecule being associated with one molecule of an electrolyte, forming complex ions.

The author suggests that the osmotic pressure of colloidal particles is too small to be detected, and attributes the pressures measured by Duclaux to contained electrolytes, such as HCl.

Cryoscopic data are similarly treated. R. J. C.

The Behaviour of Suspended Matter in Crystalloidal and Colloidal Conditions. Paul Rohland (*Physikal. chem. Centr.*, 1908, 6. Reprint).—The sedimentation of suspended particles is only accelerated by the addition of electrolytes when the former are of colloidal nature. The action is ascribed to the destruction of the colloidal envelope of the particles by the electrolytes. S. B. S.

Theory of Coagulation. Nicola Pappadà (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 214—216).—The author recalls certain general deductions which he has already made from observations on the properties of colloidal solutions, and points out that his views are in agreement with ultra-microscopic observations, with the electrical conducting properties, and with the phenomena of coagulation by the action of radium salts. H. M. D.

Influence of the Colloidal State on Dyeing. LÉO VIGNON (*Compt. rend.*, 1909, **148**, 1195—1197. Compare Abstr., 1898, i, 136).—The affinity of roccellinin, magenta, and Congo-red for colloidal gelatin and starch has been examined by observing the extent to which the colouring matter diffuses from the dyed jellies when these are immersed in water. It is found that starch resembles cotton, whilst gelatin resembles silk and wool, in its behaviour towards these dyes. W. O. W.

Decomposition of Substances Allied to Colloids. PAUL ROHLAND (*Zeitsch. angew. Chem.*, 1909, **22**, 931. Compare Funk, *ibid.*, 145).—The accelerating effect of the addition of calcium chloride and other salts on the sedimentation of felspar suspensions is attributed to two causes: (1) The electrostatic attractions between the suspended particles, which are surrounded by a colloidal shell, and the electrical charges of the ions; (2) the removal of the colloid water. It is found that substances which are the most hygroscopic have the greatest effects.

Finely-divided particles of talc, alumina, ultramarine, and cement can also remain in suspension for several hours. Suspensions of talc are precipitated by the addition of ammonium carbonate, calcium chloride, or calcium sulphate solutions, and those of alumina by strongly-alkaline liquids. Ultramarine suspensions are caused to deposit by alkalis and various metallic chloride and sulphate solutions.

Finely-divided particles of calcium carbonate, calcium sulphate, and barium sulphate can only remain in suspension for a relatively short time, and the addition of electrolytes has no effect. The conclusion is drawn that the latter type of suspension is of crystalloid nature, whereas the former type is of colloidal nature, that is, the particles are capable of forming in contact with water colloidal substances of the type of silicic acid, aluminium hydroxide, etc. The larger the amount of colloid formed, the greater is the tendency to form permanent suspensions. J. J. S.

Size and Electric Charge of the Oil Particles in Oil-Water Emulsions. WILLIAM C. McC. LEWIS (*Zeitsch. Chem. Ind. Kolloide*, 1909, **4**, 211—212).—The emulsion obtained by violently agitating water with a mineral oil (D 0·9) for about forty-eight hours is stable for many weeks, and contains oil particles, the average diameter of which is 4×10^{-5} cm. The emulsions obtained: (1) by boiling water in contact with a small quantity of oil for about thirty hours in a vessel provided with a reflux condenser, (2) by dissolving the oil in alcohol and pouring the solution into water, (3) by the distillation of aniline in steam, all contain oil particles of the same order of magnitude, which is, moreover, the size of the particles in colloidal solutions of metals.

The oil particles are negatively charged, and move with a velocity of $4{\cdot}3 \times 10^{-4}$ cm. per second when the potential fall is 1 volt per cm. The difference of potential between the oil particles and the water is 0·05 volt, and the charge on the particles is $4{\cdot}4 \times 10^{-7}$ electrostatic units, this being approximately the same as the charge on colloidal metal particles. H. M. D.

Conception of the Element. W. A. Kurbatoff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 304—310. Compare Mieli, Abstr., 1908, ii, 478).—The author discusses the various conceptions of the element which have been held from time to time, including those introduced by Boyle, Lavoisier, Ostwald, Mendeléeff, Mieli, etc., and gives the following definitions. An atom is an object such that division thereof by external forces does not yield two or more objects of the same category. Atoms of the elements are complexes of atoms of a lower category which on decomposition yield in the free state electrons or groups of electrons, and the properties of which give them a place in the periodic system. Chemical elements are complexes of properties connected one with the other and passing from one substance to another, the magnitudes of the properties allowing them to be placed in the periodic system. T. H. P.

True Atomic Weights According to Stas's Determinations. III. Louis Dubreuil (*Bull. Soc. chim.*, 1909, [iv], 5, 341—348).—By a similar method to that employed in the case of silver (compare Abstr., 1908, ii, 936, 1035; this vol., ii, 140), the author has recalculated the true atomic weights of lead, oxygen, sulphur, and nitrogen from the values obtained by Stas for the analytical ratios $Pb(NO_3)_2/Pb_2$ and $PbSO_4/Pb$ with the following results:

	$Pb(NO_3)_2/Pb$.	$PbSO_4/Pb$.
Pb	206·9984 ; 206·9983 ; 206·9985	206·9971
O	16·0162 ; 16·0172 ; 16·0150	16·0250
N	14·0054 ; 14·0057 ; 14·0050	—
S	— — —	32·0062

M. A. W.

Exact Determination of Water of Crystallisation as Applied to Researches on Atomic Weights. Philippe A. Guye and Demétrius E. Tsakalotos (*J. Chim. Phys.*, 1909, 7, 214—231).—During the last century a great number of atomic-weight determinations have been made which depend on the ratio between an anhydrous salt and the water of crystallisation of the hydrated salt. The method is very convenient, but the preparation of the dry hydrated salt has generally been effected in a purely empirical manner, and the determination of the water of crystallisation has not been exact.

After a discussion, from a physico-chemical standpoint, of the various principles involved, the authors describe special apparatus which they have designed for (*a*) drying the hydrated salt, (*b*) dehydrating the salt, (*c*) weighing the anhydrous salt. A number of experiments have been carried out on barium chloride. The results show that the ratio $BaCl_2,2H_2O/BaCl_2$ can be determined with great accuracy, the values obtained agreeing with each other to within one part in 10,000—20,000. They cannot be used, however, for the calculation of the atomic weight of barium, since the barium chloride was not quite pure, having been recrystallised in glass vessels, and, moreover, the crystallised salt is probably not a chemical individual but a solid solution of hydrated and anhydrous salt. T. S. P.

Inorganic Chemistry.

Molecular Condition of Chlorine Exposed to Light. Gottfried Kümmell and F. Wobig (*Zeitsch. Elektrochem.*, 1909, 15, 252—254).—The density of pure chlorine is determined by weighing it in glass bulbs filled (*a*) in the dark, (*b*) when exposed to the light of two arc lamps. The mean of the first set is 2·453, that of the second, 2·476. If bulbs filled in the light are kept in the dark for five or ten minutes before sealing them, the high density is still found. The authors consider that no dissociation occurs, but that possibly the glass takes up chlorine under the influence of light. T. E.

Activity of the Halogens, Chlorine, Bromine, and Iodine in Relation to Salts in General. M. C. Schuyten (*Chem. Zeit.*, 1909, 33, 480. Compare Abstr., 1908, ii, 683).—Experiments showing that several sulphates and nitrates take up traces of halogen, probably by a substitution process. The annexed table shows the results: + positive, – negative, ? uncertain, * precipitate.

H_2SO_4	Pb	Ag	Hg′	Hg″	Cu	Bi	Cd	Al	Cr	Zn	Mn	Fe″	Fe‴	Co	Ni	Ba	Sr	Ca	Mg	K	Na	NH_4
Cl	+		–*	–*	+		+	+	–	–*	+*	+*		+*	+	–	–	+	+?	+	+	+
Br	+		–*	–*	+		+	+	+	+	+*	+*		+*	+	–	–	+	+	+	+	+
I	+		–*	*	+		+	+	+	+	+	+*		+	+	–	–	+	+	+	+	+
HNO_3																						
Cl	+	+	+*	–	+	–	+	+	+	+	+		+	+*	+	+	+	+	+	+	+	+
Br	+*	+	+*	–	+	–	+	+	+	+	+*		+	+*	+	+	+	+	+	+	+	+
I	+	+	+*	–	+	–	+	+	–	+	+		–	+	+	+	+	–	+?	+	+	+

Salts with acids weaker than the halogen hydrides exhibit this property in a still higher degree, for instance, sodium dihydrogen phosphate. L. de K.

Hybrid Elements. Max Le Blanc and D. Reichinstein (*Zeitsch. Elektrochem.*, 1909, 15, 261—264).—The behaviour of iodine, arsenic, antimony, and phosphorus is studied by the method previously applied to tellurium and other elements (Abstr., 1906, ii, 742). An iodine anode dissolves quantitatively in 2*N*-sulphuric acid (when the current density is small) with the valency 5. The same valency is found in solutions of sodium chloride and carbonate and of iodic acid. The iodine therefore dissolves as IO_3'. When used as cathode, the iodine dissolves with valency 1 in the form of iodion, I'. The potential difference between arsenic and sulphuric acid is almost the same whether the arsenic is anode or cathode, and the same is true when a solution of sodium hydroxide is used as electrolyte. Arsenic dissolves with the valency 3 both as anode and cathode. Antimony behaves in much the same way as arsenic. Its cathodic valency in sodium hydroxide solution could not be determined, because the antimony hydride (or possibly sodium antimonide) formed appeared to decompose at once. Phosphorus exhibited no electromotive activity. T. E.

Preparation of Pure Iodic Anhydride. Marcel Guichard (*Compt. rend.*, 1909, **148**, 923—925).—Iodic acid is practically insoluble in nitric acid of D = 1·4, and the impure acid, prepared by the action of sulphuric acid on barium iodate, can easily be purified by adding the aqueous solution to an equal volume of nitric acid, D = 1·33, and concentrating until the iodic acid separates. The process is repeated several times if necessary. When iodic acid is prepared by the action of fuming nitric acid on iodine, the yield is only about 4%, but a yield of 40% is obtained by the action of the vapour of nitric anhydride on iodine. The iodine, wetted with fuming nitric acid, is spread out in a tube 80 cm. long and 2·5 cm. wide, which is connected to a tubulated retort, in which the nitric anhydride is prepared by gently heating a mixture of fuming nitric acid and phosphoric oxide. G. S.

Influence of the Silent Electric Discharge on Certain Mixtures of Gases and Vapours. Ezio Comanducci (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], **15**, 15—17).—When a mixture of oxygen and an oxidisable substance is subjected to the action of the silent discharge, for instance, by being passed through an ozoniser, the substance undergoes more or less oxidation, no more ozone being formed (compare Losanitsch and Jovitschitsch, Abstr., 1897, i, 179; 1908, i, 866, ii, 32; Löb, Abstr., 1908, i, 117).

Thus water is formed from oxygen and hydrogen when these are in almost equal proportions, or when the latter predominates, but if the oxygen is in excess, water and ozone are formed, and not hydrogen peroxide. Chlorine or hydrochloric acid and oxygen yield hypochlorous anhydride or acid, the amount of the latter being, in one instance, 6·59% of that of the hydrogen chloride taken. Mixed with oxygen, methyl and ethyl alcohols give the corresponding aldehydes; ethyl ether, acetaldehyde and paraldehyde give acetic acid, and formaldehyde, formic acid.

The hydrogenating power of hydrogen is increased by the dark discharge; thus a good yield of hydrogen chloride is obtained from hydrogen and chlorine, whilst acetaldehyde and hydrogen give ethyl alcohol.

Carbon disulphide and acetone are not oxidised by this method; ammonia yields traces of hydroxylamine, but no hydrazine or nitrous acid; carbon monoxide and chlorine do not react. T. H. P.

Hydrogen Persulphides. Giuseppe Bruni and Alessandro Borgo (*Atti R. Accad. Lincei*, 1909, [v], **18**, i, 355—361).—The authors have investigated the persulphides, H_2S_2 and H_2S_3 (compare Bloch and Höhn, Abstr., 1908, ii, 579), by the methods previously employed by them (Abstr., 1908, ii, 102).

Attempts to prepare higher sulphides by leaving hydrogen disulphide or trisulphide in contact with sulphur for forty-eight hours at the ordinary temperature, either alone or dissolved in bromoform, were unsuccessful. The successive decomposition of the various hydrogen polysulphides, $H_2S_7 \longrightarrow H_2S_6 \longrightarrow H_2S_3 \longrightarrow H_2S_2 \longrightarrow H_2S$, is hence not a reversible reaction.

The authors reply to Paternò's criticisms (this vol., ii, 118) on their former work (*loc. cit.*) (compare also Borgo and Amadori, this vol., ii, 309; Schenck and Falcke, Abstr., 1908, ii, 762). T. H. P.

Action of Hydrogen Peroxide on Thiosulphates in Presence of Metallic Salts. NAZARENO TARUGI and G. VITALI (*Gazzetta*, 1909, 39, i, 418—425).—Phenolphthalein, which was employed by Willstätter (Abstr., 1903, ii, 543) for measuring the alkalinity developed in the interaction of hydrogen peroxide and a thiosulphate, is useless for this purpose, since, when the hydrogen peroxide is perfectly neutral, a solution alkaline to this indicator is never obtained.

With methyl-orange, however, the alkalinity produced corresponds with the equation: $2Na_2S_2O_3 + H_2O_2 = Na_2S_4O_6 + 2NaOH$. After an hour, the alkalinity towards methyl-orange diminishes, and the liquid ultimately assumes a degree of acidity equal to that obtained when phenolphthalein is employed. Estimation of the SO_4 ion as barium sulphate shows that the whole of the thiosulphate exists finally as sulphate.

When the reaction takes place in presence of a salt the corresponding hydroxide of which is insoluble, such as a zinc, nickel, or cobalt salt, there is immediate precipitation of the hydroxide, and the solution remains perfectly neutral; in this manner any possible action of the hydroxyl ions on the ions derived from the dissociation of the thiosulphate is avoided. Calculation of the alkalinity developed from the amount of metallic hydroxide precipitated shows that this alkalinity is exactly double that indicated by methyl-orange, so that the whole of the sodium thiosulphate is transformed into sodium hydroxide according to the equation: $Na_2S_2O_3 + H_2O_2 = 2NaOH + S_2O_3$. There is then a further action, represented in the cold probably by $4S_2O_3 + 5H_2O_2 = H_2S_4O_6 + 4H_2SO_4$, which is in accord with Nahl's results (Abstr., 1901, ii, 16, 94), and in the hot by

$$4S_2O_3 + 5H_2O_2 = H_2S_3O_6 + 4H_2SO_4 + S,$$

which agrees with Willstätter's results (*loc. cit.*).

Hence, hydrogen peroxide is capable, under the conditions employed by the authors, of causing complete dissociation of sodium thiosulphate into $2Na^{\cdot}$ and S_2O_3'', the formation of tetrathionate being due to a secondary action of the S_2O_3 anion with excess of the peroxide, whilst trithionate is formed as the result of decomposition of the tetrathionate by heat. T. H. P.

Synthesis of Ammonia from its Elements. JAKOB LIPSKI (*Zeitsch. Elektrochem.*, 1909, 15, 189—206). The dissociation pressure of cerium nitride is measured. The material used was made either by heating a mixture of cerium dioxide and magnesium in an atmosphere of nitrogen, or from the pure metal and nitrogen. Since the first method yields a mixture of cerium and magnesium nitrides, the dissociation pressure of magnesium nitride was also studied. Equilibrium is attained very slowly; at 320° no measureable pressure was observed, and at 460° the dissociation pressure lies between 6 and 13 cm. of mercury. The experiments with cerium nitride gave somewhat inconclusive results, owing to the very slow change of pressure. The author thinks that equilibrium is probably established quickly on the surface, and that the nitride then dissolves in the metal, further change being then dependent on diffusion in the solid. The pure nitride gave the following pressures: 610°, 34 cm.; 675°, 37 cm.; 715°, 38 cm.; 762°, 40 cm., but the figures are only roughly approximate. Admixture of cerous chloride, or of alkali or earth alkali chlorides, did not accelerate the absorption or evolution of nitrogen.

The author's intention was to try the action of hydrogen and nitrogen on cerium hydride and nitride under pressure at moderately high temperatures; he observed, however, that cerium hydride smells of ammonia when exposed to the air, which led him to work at atmospheric pressure and low temperatures.

When perfectly pure, dry nitrogen is passed over the freshly prepared hydride in the cold, ammonia is formed rapidly (about one half the possible quantity in three and a-half hours); the reaction, however, soon becomes slower, probably owing to superficial formation of nitride. The reaction is $CeH_3 + N_2 = CeN + NH_3$. Raising the temperature to 200° increases the rate of reaction very little.

No ammonia is formed by the action of hydrogen on cerium nitride in the cold, but the reaction $CeN + 3H_2 = CeH_3 + NH_3$ takes place at temperatures between 100° and 400°, the best temperature being about 200°; the rate of formation falls off less rapidly than is the case with the hydride.

By allowing a mixture of hydrogen and nitrogen to act on cerium nitride at 250°, 25·1 c.c. of gas disappeared, and ammonia equivalent to 26·9 c.c. was formed, but the reaction stopped completely in twenty-four hours; the action is, therefore, purely catalytic; traces of oxygen and moisture in the gas possibly account for its cessation.

Experiments made with nitride and hydride, prepared from commercial cerium carbonate by converting this into the dioxide and heating it with magnesium in a current of hydrogen or nitrogen, showed them to be equal to the purer substances.

A number of experiments were made in order to find the best conditions for a continuous production of ammonia. The reaction soon stops if a mixture of nitrogen and hydrogen is used, but it goes on continuously (although slowly) when nitrogen and hydrogen are passed alternately at short intervals. A mixture of hydride and nitride gives the best results, and the rate of production is very much increased by spreading the material out over a large surface of asbestos, glass wool, or copper gauze. When the contact material is allowed to cool off and remain unused for some hours, its activity increases. The quantity of ammonia produced is proportional to the quantity of contact material used, and independent, within fairly wide limits, of the rate of passage of the gas. The highest concentration of ammonia reached by the author was 6·4% by volume in the gas passed over cerium nitride, and 1·4% over the hydride.

T. E.

Phosphates, their Isomerism and the Transformations they Undergo in Soil. Antonio Quartaroli (*Staz. sper. agrar. Ital.*, 1909, 42, 121—160).—The author has investigated various phosphates in order to obtain an explanation of the contradictory views concerning their efficacy as manures and the changes they undergo in the soil.

Two forms of dicalcium phosphate exist: (1) the amorphous variety, which undergoes complete solution on addition of a quantity of phosphoric acid sufficient to transform it into the monocalcium salt, and is converted into tricalcium phosphate by means of calcium hydroxide; (2) the crystalline variety, which dissolves with difficulty in citric acid, and is not converted into the tricalcium salt by calcium hydroxide, or into the monocalcium salt by a strong acid.

Further, the amorphous form is markedly decomposed by water, whilst the crystalline form is not. Also, tricalcium phosphate exists in two modifications, one of which is convertible into the dibasic phosphate and is hydrolysed by water, whilst the other cannot be changed into the dibasic salt and is not decomposed by water.

These observations are explained by the author as due to the existence of an asymmetric phosphoric acid, $\overset{+}{H} \mid H_2PO_4$, and a symmetrical one, $\overset{++}{H_2} \mid PO_4$, and thus of asymmetric and symmetrical salts, $ca \mid caHPO_4$ and $\begin{matrix} ca \\ ca \end{matrix} \Big| \, HPO_4$, only the former of which is capable of yielding monocalcium phosphate. Similarly, with the tricalcium salt, there should be an asymmetric form, $ca \mid ca \mid ca \mid PO_4$, two partially symmetrical forms, $\begin{matrix} ca \\ ca \end{matrix} \Big| \, ca \, \Big| \, PO_4$ and $ca \, \Big| \begin{matrix} ca \\ ca \end{matrix} \Big| \, PO_4$, and a symmetrical form, $\begin{matrix} ca \\ ca \\ ca \end{matrix} \Bigg| \, PO_4$. Of these, the first is capable of yielding di- and mono-calcium salts and free phosphoric acid when treated with acid, the second giving symmetrical dicalcium phosphate and phosphoric acid, the third, monocalcium phosphate and phosphoric acid, and the fourth, only phosphoric acid.

T. H. P.

Formation of Graphite by the Interaction of Magnesium Powder and Carbonates. H. Russell Ellis (*Trans. Faraday Soc.*, 1909, 4, 172—174).—In the reduction of barium, strontium, or calcium carbonate by magnesium, the carbon obtained is partly in the form of graphite. Small quantities of graphite are found in the carbon obtained by passing carbon dioxide over heated magnesium.

C. H. D.

Thiocarbonates. Nazareno Tarugi and A. Magri (*Gazzetta*, 1909, 39, i, 405—418).—When an aqueous solution of potassium thiocarbonate is boiled out of contact with air and in an atmosphere of nitrogen, the first phase of the decomposition occurring is represented by the equation $K_2CS_3 = K_2S + C_2S$. The potassium sulphide thus formed subsequently undergoes hydrolysis, giving potassium hydroxide and hydrogen sulphide: $K_2S + 2H_2O = 2KOH + H_2S$. In presence of air or oxygen, the decomposition of the thiocarbonate effected by boiling its solution is represented by the equation: $2K_2CS_3 + 2H_2O + 4O = K_2S_2O_3 + K_2CO_3 + CS_2 + 2H_2S$. Finally, in an atmosphere of carbon dioxide, decomposition occurs according to the equation $K_2CS_3 + CO_2 + H_2O = K_2CO_3 + CS_2 + H_2S$. The equation $K_2CS_3 + 3H_2O = K_2CO_3 + 3H_2S$, usually given in the literature as representing the decomposition of alkali thiocarbonates in solution, is hence in direct contradiction to the truth.

Under the action of sunlight and in presence of air, solutions of thiocarbonates undergo, at the ordinary temperature and with an increased velocity, the same tranformation as takes place on boiling in absence of sunlight. In vessels evacuated and then exposed to sunlight, thiocarbonates remain unaltered for a long time, the equilibrium $K_2CS_3 \rightleftharpoons K_2S + CS_2$ not being disturbed by the removal of one of the products of the decomposition.

Towards organic compounds, thiocarbonates behave in such a way as to confirm the fact that they decompose into a sulphide and carbon disulphide. Thus, with aniline, potassium thiocarbonate yields the condensation product of thioformanilide (compare Nicol, Abstr., 1882, 958).

Under other conditions, thiocarbonates behave like simple sulphides; thus benzoyl chloride and a thiocarbonate in equimolecular proportions yield benzoyl disulphide, which is also formed by the interaction of benzoyl chloride and potassium hydrogen sulphide. T. H. P.

Action of some Oxidising Agents on Silicochloroform. Adolphe Besson and L. Fournier (*Compt. rend.*, 1909, 148, 1192—1194. Compare this vol., ii, 398, 399).—In sunlight, dry oxygen slowly attacks silicochloroform at −80°, forming the compound Si_2OCl_6 with other oxychlorides. Ozone has a similar action, but forms, in addition, a small quantity of silica, with oxychlorides of high molecular weight. An explosion occurs when nitrogen peroxide is mixed with silicochloroform at −20°; when the materials are diluted with carbon tetrachloride, however, a reaction occurs, represented by the equation: $SiHCl_3 + 2NO_2 = SiO_2 + 2NOCl + HCl$.

Silicochloroform reacts with sulphur trioxide at 100°, forming sulphur dioxide, pyrosulphuryl chloride, $S_2O_5Cl_2$, and probably chlorosulphonic acid, together with viscous oxychlorides of silicon. Under certain conditions, a blue compound, probably the oxide, S_2O_3, is obtained.

Silicochloroform and chromium trioxide react at the ordinary temperature, forming oxychlorides of silicon and a *compound*, Cr_3OCl_7. This is an unstable, brown powder soluble in water with decomposition.

W. O. W.

Stas's Investigation of the Solubility of Silver Chloride. KARL DRUCKER (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 216—219).—Experimental observations made by Stas in an investigation on the haloid salts of silver (*Oeuvr. compl.*, 1, 87) are reviewed from the colloido-chemical standpoint. The facts indicate the existence of a whole series of reproducible forms of silver chloride ranging from the true gel to the crystalline form. Each of these has a definite solubility, which increases as the colloidal character of the chloride increases. A comparison is made between the influence of the form of the substance on its solubility and that of temperature on the miscibility of two liquids.

H. M. D.

Crystals of Calcium Hydroxide in Roman Cement. SERGEI F. GLINKA (*Zeitsch. Kryst. Min.*, 1909, 46, 303—304; from *Cement*, 1904, 37—43, 217—225).—Small tabular crystals of calcium hydroxide were observed in a hydraulic cement and also in a Roman cement. They are hexagonal, with a perfect basal cleavage, $a:c = 1:1\cdot20$; D 2·254; H 2—3; refractive indices, $\omega = 1\cdot644$, $\epsilon = 1\cdot446$. These crystals are not isomorphous with the mineral brucite (MgO,H_2O).

L. J. S.

Colloidal Barium Sulphate. ERNEST FEILMANN (*Trans. Faraday Soc.*, 1909, 4, 175—178).—When barium chloride is added to a mixture of sodium sulphate and alkaline casein solution, a creamy liquid is obtained, from which acetic acid precipitates a curd-like mass. After washing and adding sodium hydroxide solution, a milky liquid is obtained, yielding a translucent solid on evaporation. This solid yields a stable colloidal solution. The particles of barium sulphate are probably surrounded by a protective layer of casein.

C. H. D.

Electrical Properties (Thermoelectricity and Resistivity) of Copper-aluminium Alloys. HECTOR PÉCHEUX (*Compt. rend.*, 1909, 148, 1041—1042. Compare this vol., ii, 294).—The author has measured the thermoelectric properties and specific resistance of six commercial copper-aluminium alloys containing 3, 5, 6, 7½, 10, and 94% of aluminium respectively. The *E.M.F.* of a thermojunction of each alloy with electrolytic copper was determined at a series of temperatures up to 820°. The variation of *E.M.F.* with temperature (dE/dt) is in all cases very approximately equal to $(A + Bt)$, where A and B are constants for each alloy, that is, the *E.M.F.* obeys a parabolic law.

As the percentage of aluminium increases from 3 to 10, the *E.M.F.* of the couple falls, but beyond this increases, so that the *E.M.F.* of the 94% alloy approaches that given by pure aluminium. The order of the alloys in this property, which is not the same as their order in composition, is often modified by temperature changes.

A small proportion of aluminium greatly increases the resistivity of copper, but addition of 6% of copper to aluminium does not increase the resistance of the latter. The alloy 7½% aluminium, 92½% copper exhibits a maximum of resistivity. R. J. C.

Cuprous Hydroxide and Cuprous Oxide. HORACE W. GILLETT (*J. Physical Chem.*, 1909, 13, 332—335).—It is known that yellow cuprous hydroxide or red cuprous oxide, or a mixture of the two, is obtained by electrolysis of sodium chloride solution between copper poles according as the temperature is below 60°, above 95°, or intermediate. The author has endeavoured to obtain precipitates of the red cuprous oxide at the ordinary temperature.

Addition of extremely concentrated sodium hydroxide to cuprous chloride dissolved in sodium chloride gives a precipitate of red oxide, but elevation of temperature is much more effective than increase of concentration, although cuprous hydroxide, once formed, cannot be dehydrated by eighty hours' boiling.

The electrolysis of sodium chloride proceeds normally in presence of acid. On the other hand, when only 0·5% of sodium hydroxide is present, oxygen is evolved at the anode, and no oxidation of the copper occurs. With less alkali, in addition to cuprous hydroxide, some indication of oxide is observed. In no case is the amount of oxide formed on the anode more than 1% of the whole precipitate.

When a thick paper diaphragm is interposed between the electrodes, yellow cuprous hydroxide appears on both sides, but unmistakable scarlet oxide is deposited in the paper itself. No explanation of this is offered. R. J. C.

Isomorphism and Polymorphism of the Mercury Haloids. W. J. LUCZIZKY (*Zeitsch. Kryst. Min.*, 1909, 46, 297—298; from *Bull. Ges. Naturf. Kiew.*, 1906, 20, 191—207).—Crystals of mercury iodide, bromide, and chloride, and mixed crystals of the iodide and bromide and of the chloride and bromide (but not of the iodide and chloride) were obtained from solutions in ethyl and methyl alcohols. The several modifications are tabulated as follows:

	HgI_2.	$HgBr_2$.	$HgCl_2$.
First modification	Tetragonal	—	—
Second ,, ...	Rhombic	Rhombic α	Rhombic β
Third ,, ...	—	Rhombic β	Rhombic α

Rhombic crystals, probably representing a double salt, $HgCl_2,HgBr_2$, were also obtained. L. J. S.

Preparation of Pure Cerium Salts and the Colour of Cerium Oxide. ARTHUR C. NEISH (*J. Amer. Chem. Soc.*, 1909, 31, 517—523). —A study has been made of the methods of preparing pure cerium salts, and special attention has been devoted to cerium oxide, CeO_2, the colour of which has been the subject of much controversy. The following method is recommended for preparing pure cerium salts from the crude oxalate.

The oxalate is first heated with dilute hydrochloric acid in order to remove iron, calcium, etc., and the residue is treated with hot ammonium oxalate solution. The purified oxalate is then heated with a solution of potassium hydroxide in order to free it from aluminium, etc. The hydroxide thus obtained is dissolved in sulphuric acid, and the solution is treated with potassium sulphate, yttrium, ytterbium, erbium, and samarium being thus eliminated. The crystalline double sulphate produced is dissolved in dilute hydrochloric acid, potassium hydroxide is added, and the mixture is heated until all the cerium has been re-precipitated as hydroxide. The hydroxide is treated with dilute potassium hydroxide, and chlorine is slowly bubbled through the mixture. This treatment is repeated until the oxide is free from lanthanum and didymium. The hydroxide is now boiled with dilute hydrochloric acid, and hydrogen peroxide is added to effect complete solution and reduce the ceric chloride to the cerous condition. After adding concentrated hydrochloric acid and heating the solution nearly to boiling, a solution of oxalic acid is added, and, on cooling, crystals of cerium oxalate separate. By heating this oxalate in hydrogen and afterwards in pure oxygen, pure ceric oxide is obtained. This oxide has a pale yellow colour, resembling that of chamois leather.

The occurrence of a red or pink colour indicates the presence of coloured oxides, whilst if the preparation is very pale or almost white, it contains white oxides as impurities. The colour of the pure oxide is not due to the presence of nitrogen from the air, since the colour is the same whether ignition is carried out in dry air, free from carbon dioxide, or in pure oxygen. E. G.

Heats of Combustion of Aluminium, Calcium, and Magnesium. FRANK E. WESTON and H. RUSSELL ELLIS (*Trans. Faraday Soc.*, 1909, 4, 166—171. Compare this vol., ii, 46).—In further experiments on the thermite reaction, aluminium is found to reduce lime only when heat is supplied; magnesia is not reduced. Heating calcium with magnesia results chiefly in the formation of nitride.

C. H. D.

Peroxides. SEBASTIAN TANATAR (*Ber.*, 1909, 42, 1516—1517).—According to Pellini and Meneghini (this vol., ii, 50), nickel peroxide does not reduce permanganate, contrary to the statement of the author (Abstr., 1900, ii, 211). It is now shown that the peroxide prepared by means of sodium hypobromite reduces permanganate, and that hydrogen peroxide may be prepared from it in quantity by the action of hydrogen cyanide and potassium cyanide. Hydrogen peroxide could not be obtained in this way from cobalt or lead peroxides, or from silver peroxynitrate (Abstr., 1902, ii, 73). The "true nickel peroxide" of Pellini and Meneghini is probably a molecular compound of nickel hydroxide and hydrogen peroxide (compare Willstätter, Abstr., 1903, ii, 537). C. H. D.

Signification of Colloidal Solutions of Manganese Oxide in Biochemical Oxidations. BOUWE SJOLLEMA (*Chem. Weekblad.*, 1909, 6, 287—294).—The influence of manganese compounds on biochemical oxidations has been investigated. A colloidal solution of an oxide of manganese higher than manganous oxide was obtained by treating manganese sulphate or acetate with potassium sodium tartrate, and then with hydrogen peroxide and dilute sodium hydroxide. When protected from light, the solution thus obtained remains unaltered for some weeks, retaining its dark brown colour. Its colloidal nature was proved by dialysis. It gives characteristic reactions with oxydase reagents, irrespective of whether it has been dialysed or not. It at once imparts a blue colour to an alcoholic solution of guaiacum resin, and to a solution of *p*-phenylenediamine hydrochloride. In presence of light, it oxidises quinol rapidly, yielding crystals of quinhydrone. Aniline sulphate is at once coloured violet or blue. Pyrogallol is oxidised, yielding a dark-coloured precipitate. It acts as a catalyst, decomposing hydrogen peroxide. It does not oxidise hydriodic acid in neutral, alkaline, or acid solution. It does not oxidise tyrosine in acid or alkaline solution, in this respect resembling the ordinary oxydases.

The oxidation of quinol, pyrogallol, and hydrogen peroxide has been studied qualitatively, the results indicating that a colloidal solution of higher oxides of manganese behaves in many respects like an oxydase. The author considers that the part played by manganese in biochemical oxidations is often important, and probably also in oxidations in the soil. A. J. W.

Preparation, Composition, and Thermal Properties of Electrolytic Iron. ARTHUR MÜLLER (*Metallurgie*, 1909, 6, 145—160).—For the preparation of electrolytic iron from ferrous ammonium sulphate, anodes of pure iron should be used, enclosed in porous cells, and the anode mud frequently removed. Low current density and temperature should be employed. The cathode deposit still contains some sulphur, and to obtain a pure product the electrolysis should be repeated, using ferrous chloride as the electrolyte. The final product contains only 0·03% total impurities, of which 0·02% is carbon. Hydrogen and nitrogen are also present to the extent of 0·02—0·08% and 0·02—0·03% respectively.

The thermal behaviour has been investigated, using a vacuum furnace with carbon spiral resistance, the construction being a modification of that adopted by Oberhoffer (Abstr., 1907, ii, 736). In this furnace, 70 grams of iron may be raised to above 1700° in twenty minutes.

After melting in a magnesia crucible, the iron contains 0·017% C, 0·089% Si, 0·028% P, 0·025% Mn, and 0·037% S. The values found for the critical points are Ar_3 894°, Ac_3 917°, Ar_2 763°, Ac_2 770°. A critical point between 1000° and 1500° could not be observed. The iron, after melting, is silver-white with crystalline fracture. It is perfectly malleable, and so soft as to be cut with a knife. C. H. D.

The Electrolytic Theory of the Corrosion of Iron. WILLIAM H. WALKER (*J. Iron and Steel. Inst.*, 1909, i. Compare Walker, Cederholm, and Bent, Abstr., 1907, ii, 875; Friend, Abstr., 1908, ii, 698).—The electrolytic corrosion of iron begins even in the absence of an acid. Ferrous ions pass into the water, hydrogen being deposited in a film and hydroxyl ions being left in solution. Friend's analytical methods were insufficiently delicate to detect these minute quantities, but both ions may be made evident by the use of gelatin containing potassium ferricyanide and phenolphthalein, called the ferroxyl reagent. In the absence of an acid, the polarising film of hydrogen prevents further action. C. H. D.

Influence of the Treatment on the Solubility of Iron and Steel in Sulphuric Acid. E. Heyn and O. Bauer (*J. Iron and Steel Inst.*, 1909, i. Compare Abstr., 1908, ii, 849).—The effect of quenching and tempering on the solubility in acid of steel containing 1% of carbon has been studied. The hardened steel (martensite) becomes more soluble in 10% sulphuric acid if reheated until 400° is reached, after which the solubility again diminishes. The steel of maximum solubility is called by the authors "osmondite"; it passes through troostite into martensite, on the one hand, and through sorbite into pearlite, on the other. The troostites leave their whole carbon content in the form of carbon free from iron, whilst pearlite contains only carbide carbon, which is evolved in the form of hydrocarbons in the action of acid.

In the tempering of martensite, the greatest development of heat is below the osmondite point.

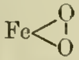
Steel containing only 0·07% C also shows a maximum solubility when tempered at 400°, indicating that the allotropy of the iron has an influence on solubility.

The solubility of soft steel is increased by cold-working, but again diminished by reheating, heating even to 100° having a marked effect. A permanent strain of only 2% in length may be detected in this way. On the other hand, cold-worked aluminium is less soluble than annealed metal. The same holds good of copper, but in this case the changes are very small. C. H. D.

The Decarburisation of Iron-Carbon Alloys. William H. Hatfield (*J. Iron and Steel. Inst.*, 1909, i. Compare Wüst, Abstr., 1908, ii, 286).—Experiments with iron containing 1·64% of carbon in the form of cementite show that temper carbon is not formed in the decarburising process, and that practically the whole of the carbon may be removed by oxidation. This disproves Wüst's theory that the carbon is only oxidised after intermediate formation of temper carbon. The results are confirmed by the behaviour of white iron. The reaction between the carbide and the oxidising medium begins at 750°.

C. H. D.

Formation of True Peroxides of Iron. Giovanni Pellini and D. Meneghini (*Gazzetta*, 1909, 39, i, 381—398; *Zeitsch. anorg. Chem.*, 1909, 62, 203—217. Compare this vol., ii, 50).—The action of hydrogen peroxide on ferrous or ferric chloride, ferrous hydroxide, or ferric oxide gives rise to a very ustable, pale red substance, which has a less colloidal appearance than ferric hydroxide and all the characters of the true peroxides. The composition of this substance cannot be established with certainty, owing to its instability, to admixture of varying proportions of ferric oxide, and to the presence of alkali chloride in the precipitates obtained by the action of alkali on ferrous and ferric chlorides. In the peroxides obtained by the authors, the ratio Fe : O never exceeds 2, and, as the results of Manchot and Wilhelms (Abstr., 1901, ii, 658; 1903, ii, 152) and of Just (Abstr., 1907, ii, 852) indicate that the ratio Fe : O cannot be less than 1 : 3 or more than 1 : 2, the authors' peroxides correspond with a mixture of ferric oxide and peroxide. The constitution of the peroxide is



or O:Fe·O·O·Fe:O.

An alcoholic solution of ferrous chloride exhibits a yellowish-green coloration, the intensity of which is only slightly diminished by intense cold; with ferric chloride, the solution has a yellowish-brown colour, which fades appreciably on cooling. The solution of the ferrous salt reacts energetically with hydrogen peroxide, developing a considerable amount of heat and an intense brown coloration, which is not sensibly lightened by cooling; the solution of the ferric salt reacts at most feebly with hydrogen peroxide, the liquid obtained not differing appreciably from the original solution, and losing its colour in the same way on cooling. This behaviour indicates that some sort of chemical combination takes place between the ferrous salt and hydrogen peroxide, whilst with ferric chloride such combination takes place either not at all or only extremely slowly. T. H. P.

Chemical and Magnetic Study of Complex Compounds. P. Pascal (*Ann. Chim. Phys.*, 1909, [viii], **16**, 359—402, 520—574).—A résumé of work already published (compare Abstr., 1908, ii, 193, 500, 756, 757, 927, 1013). The ferropyrophosphates reduce organic compounds at least as readily as do ferrous oxalate or ferrous hydroxide; picric acid, on reduction with ferrophosphates in the cold, yields picramic acid, whilst at 60° the reduction proceeds further, with the formation of nitrodiaminophenol; similarly, trinitroresorcinol yields dinitroaminoresorcinol. Nitrobenzene is not appreciably reduced by ferrophosphates even on prolonged heating at 60°. *p*-Nitrophenol is slowly reduced to *p*-aminophenol, whilst *m*-nitrophenol is readily reduced even in the cold to the corresponding aminophenol and azo-compound. M. A. W

Revision of the Atomic Weight of Chromium. I. Analysis of Silver Chromate. Gregory P. Baxter, Edward Mueller, and Murray Arnold Hines (*J. Amer. Chem. Soc.*, 1909, **31**, 529—541[*]).—The results of determinations of the atomic weight of chromium hitherto recorded show considerable discrepancy, and a re-determination has therefore appeared desirable. Careful analyses of silver chromate have been carried out, this substance being chosen since it can be obtained of definite composition, and can be completely dried without decomposition. The chromate of silver is also very suitable for the purpose on account of the ease with which its silver can be estimated. In order to determine the ratio of the atomic weight of chromium to that of silver or oxygen, the exact ratio of the atomic weights of silver and oxygen should be known. Although this knowledge is at present

[*] and *Zeitsch. anorg. Chem.*, 1909, **62**, 313—330.

lacking, the data obtained by the analysis of silver chromate will be subsequently available for the calculation of the atomic weight of chromium. The methods employed in preparing pure silver chromate and effecting its analysis are described in detail.

In some experiments, the silver was precipitated as chloride, and in others as bromide. From the average of three experiments with two different samples of the chromate, the ratio $2AgCl : Ag_2CrO_4$ was found to be 0·864094 [$Ag : AgCl = 0·752632$ (Richards and Wells, Abstr., 1905, ii, 451)], and the percentage of silver in the chromate, 65·0345. From the average of eleven experiments with four different samples of the chromate, the ratio $2AgBr : Ag_2CrO_4$ was found to be 1·13207 [$Ag : AgBr = 0·574453$ (Baxter, Abstr., 1906, ii, 740)], and the percentage of silver in the chromate, 65·0321. The average result of all the analyses gives Ag = 65·0333%. Assuming certain values for the atomic weight of silver referred to oxygen as 16·000, the atomic weight of chromium is found to have the following values: Cr = 52·06 [Ag = 107·93]; Cr = 52·01 [Ag = 107·88]; Cr = 51·98 [Ag = 107·85].

Pure, unfused silver chromate has D^{25}_4 5·625. E. G.

Revision of the Atomic Weight of Chromium. II. Analysis of Silver Dichromate. GREGORY P. BAXTER and RICHARD HENRY JESSE, jun. (*J. Amer. Chem. Soc.*, 1909, 31, 541—549*).—Baxter, Mueller, and Hines (preceding abstract) have prepared and analysed pure silver chromate with a view to throwing light on the atomic weight of chromium. A similar investigation has been carried out with silver dichromate, which has the advantages of containing a much larger proportion of chromium than silver chromate and of being readily crystallised from nitric acid, and thus freed from impurities carried down with it during precipitation. The pure salt was carefully prepared and analysed by methods which are described. Silver dichromate cannot be completely dried without decomposition, and, when crystallised from nitric acid, retains traces of the acid. Since, however, the silver and chromium are present in equivalent proportions, the inclusion of mother liquor can do no harm. Estimations were made of moisture and nitric acid in specimens of the salt crystallised from nitric acid of different concentrations.

From the average of nine analyses of three different samples of the dichromate, the ratio $2AgBr : Ag_2Cr_2O_7$ was found to be 0·869856 [$Ag : AgBr = 0·574453$ (Baxter, Abstr., 1906, ii, 740)], and the percentage of silver in the salt, 49·9692. Assuming certain values for the atomic weight of silver referred to oxygen as 16·000, the atomic weight of chromium is found to have the following values: Cr = 52·06 [Ag = 107·93]; Cr = 52·01 [Ag = 107·88]; Cr = 51·98 [Ag = 107·85]. These values are identical with those obtained by Baxter, Mueller, and Hines (*loc. cit.*).

Silver dichromate has D^{25}_4 4·770. E. G.

Solubility of Ammonium Metavanadate. JULIUS MEYER (*Zeitsch. Elektrochem.*, 1909, 15, 266—268).—The solubility of ammonium metavanadate in water is (in gram-molecules per litre): 18°, 0·0372;

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* and *Zeitsch. anorg. Chem.*, 1909, 62, 331—343.

25°, 0·0519; 35°, 0·0898; 45°, 0·1341; 55°, 0·1704; 70°, 0·2599. In 0·05*N*-ammonium chloride solution, the solubilities are: 18°, 0·0142; 25°, 0·0225; 35°, 0·0445; 45°, 0·0757; 55°, 0·0954. In 0·1*N*-ammonium chloride they are: 18°, 0·00356; 25°, 0·00995; 35°, 0·0235; 45°, 0·0451; 55°, 0·0631. Each of these sets of results shows a change of direction in the solubility curve between 39° and 41°, indicating a change in the solid salt at this temperature. The solubility in 0·05*N*- and 0·1*N*-ammonium nitrate solutions are also measured, and found to be very slightly greater than those in the corresponding ammonium chloride solutions. The salt is very much more soluble in ammonia than it is in pure water. In 0·0677*N*-ammonia, the solubilities at 18° are 0·0476, at 25° 0·0603; in 0·2452*N*-ammonia it is at 18°, 0·0680, and at 25° 0·073; in 0·5872*N*-ammonia at 18°, 0·1029, and at 25°, 0·108.

T. E.

Action of Antimony Hydride on Dilute Silver Solutions.

Hans Reckleben (*Ber.*, 1909, **42**, 1458—1464).—The black precipitate produced by antimony hydride in silver nitrate solutions has been assumed to have the composition Ag_3Sb (Lassaigne, *J. Chim. Méd.*, 1840, **17**, 443), but secondary reactions are known to occur. The precipitate contains oxygen, but not in the form of antimonic acid, which is not produced when dilute nitric acid acts on antimony hydroxide; it has therefore been described as a mixture of metallic silver and antimony hydroxide (Vitali, Abstr., 1893, ii, 206).

Owing to secondary reactions, the method adopted in the case of arsenic hydride (Reckleben, Lockemann, and Eckardt, Abstr., 1908, ii, 36) is not applicable. The black precipitate is decolorised by oxidising agents, of which iodine is the most convenient. Iodine in presence of tartaric acid readily converts metallic antimony into antimonic acid: $Sb + 5I + 4H_2O = H_3SbO_4 + 5HI$, and the free antimony may be estimated in this way. The result of the analyses shows that the first reaction of antimony hydride with silver nitrate is that described by Lassaigne: $SbH_3 + 3AgNO_3 = Ag_3Sb + 3HNO_3$, but that the excess of silver nitrate causes the further reaction:

$$Ag_3Sb + 3AgNO_3 + 3H_2O = 6Ag + H_3SbO_3 + 6HNO_3.$$

The final precipitate therefore consists of silver and antimony hydroxide with a little metallic antimony, some antimony at the same time passing into solution.

C. H. D.

Influence of High Potential Discharge on Amorphous Gold.

Bayard G. Cobb (*Chem. News*, 1909, **99**, 209—210).—When amorphous gold, precipitated from auric chloride by ferrous sulphate, washed thoroughly many times with nitric acid, and finally with distilled water, is submitted to the influence of the high potential discharge of a ten-inch Rhumkorf coil between platinum electrodes, it becomes active towards a photographic plate, and appears to develop traces of copper. This experiment has been repeated four times with similar results, and, in addition, pure amorphous gold placed between pure platinum electrodes in a partly evacuated glass tube and subjected in a like manner to the high potential discharge for three-quarters of an hour, when subsequently dissolved and analysed, gave even more distinct indications of copper.

J. V. E.

The Supposed Hydrolytic Action of Platinum-black. W. E. Grove and Arthur S. Loevenhart (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxviii—xxix ; *J. Biol. Chem.*, 6).—After a month no hydrolysis of starch occurred on the addition of platinum-black. The effect observed by others who used large quantities is due to oxidation by the platinum oxides contained in platinum-black, but there is no evidence of catalytic action. W. D. H.

Mineralogical Chemistry.

Paraffin Content of Mineral Oils as Criterion for Judging their Relative Geological Age. Michael Rakusin (*Ber.*, 1909, 42, 1211—1215. Compare this vol., ii, 153, 246).—It is found as the result of the investigation of samples of mineral oils from the same district that the percentage of paraffin hydrocarbons present in the natural petroleum decreases with an increase in the geological age of the oil.

It is possible that in nature, fractionation of the mineral oil takes place in a manner similar to that observed by Gilpin and Cram (this vol., i, 1), as a result of which the paraffin hydrocarbons are found nearer the surface than the denser, unsaturated hydrocarbons.

W. H. G.

Gases Occluded in the Lavas of the Last Eruptions of Mounts St. Pelée and Vesuvius. Grossmann (*Compt. rend.*, 1909, 148, 991—992).—Two lavas from each volcano were examined by heating in a vacuum, the gases being absorbed by the usual reagents. Nitrogen was finally absorbed by lithium at a very dull red heat, and the residues were examined spectroscopically. The lava from Vesuvius (1906) contained much more gas than that from St. Pelée (1902). Carbon dioxide, carbon monoxide, hydrogen, and nitrogen were present in all, oxygen and methane only in Vesuvian lavas. Helium was found in one St. Pelée sample, and argon in one from Vesuvius. Ethylene, acetylene, propylene, and benzene were absent. R. J. C.

Composition of Bauxite. H. Arsandaux (*Compt. rend.*, 1909, 148, 936—938).—Fifteen specimens of bauxite have been analysed by heating each with concentrated hydrochloric acid for an hour on the water-bath, which extracts all the iron and very little aluminium ; the residue containing practically all the aluminium, and also titanium and silicon, is then treated with concentrated sulphuric acid, and the analysis completed in the usual way. By determining the proportion of water in the part insoluble in hydrochloric acid, an approximate value is obtained for the degree of hydration of the alumina. The results show that the proportion of water associated with the aluminium is independent of the proportion of iron in the mineral, and (in all cases but one) corresponds approximately with the formula Al_2O_3,H_2O. The oxide of iron is practically anhydrous. Titanium is present in very small proportion, and probably exists as metatitanic acid. The proportion of silicon varies considerably. G. S.

Three New Manganese Minerals: Vredenburgite, Sitaparite, and Juddite. L. LEIGH FERMOR (*Rec. Geol. Surv. India*, 1908, **37**, 199—212. Compare Abstr,, 1907, ii, 700; 1909, ii, 153).—*Vredenburgite* is found as crystalline masses in the manganese deposits at Beldongri in the Nágpur district, Central Provinces, India (anal. I), and at Garividi in the Vizagapatam district, Madras (anal. II). It is dull steel-grey with metallic lustre, and in strong sunlight shows a bronzy colour; the streak is dark brownish-black. There are well-marked octahedral cleavages, indicating that the mineral is either cubic or tetragonal; $H = 6\frac{1}{2}$. A striking feature is the very strong magnetism, equal to that of magnetite, which is often polar in character. The simplest formula is $3Mn_3O_4,2Fe_2O_3$. The magnetic character suggests, however, that the iron may be present as Fe_3O_4, in which case the two analyses give the formulæ

$$2Mn_2O_3,3(Mn,Fe)_3O_4 \text{ and } 7Mn_2O_3,8(Mn,Fe)_3O_4$$

respectively.

	MnO_2.	MnO.	Fe_2O_3.	Al_2O_3.	BaO.	CaO.	MgO.	SiO_2.	H_2O (at 100°).	H_2O (comb.).	Total.	Sp. gr.
I.	23·67	38·24	28·85	1·32	1·30	1·53	0·99	1·77*	0·18	1·32	—	—
II.	24·94	38·53	31·29	2·10	0·03	0·90	1·20	0·20	0·20	0·30	—	—
III.	36·79	26·89	27·60	1·02	0·10	6·14	1·02	1·17	0·09	—	–100·82	4·93

	K_2O.	Na_2O.	S.	P_2O_5.	As_2O_5.	CoO.	CuO.	TiO_2.	CO_2.	Total.	Sp. gr.
I.	—	—	—	1·07	0·01	—	—	—	0·09	100·34	4·74
II.	0·06	0·14	0·03	0·03	nil	0·05	0·03	0·14	nil	100·17	4·84

* Combined silica, 0·91; free silica, 0·86%.

Sitaparite is found, together with hollandite and other manganese minerals, at Sitapár in the Chhindwára district, Central Provinces. In its dark bronze-grey colour it closely resembles vredenburgite, but it is distinguished from this by being only feebly magnetic. It is brittle with perfect cleavages; H = 7; D 4·93—5·09. Analysis III gives the formula $10MnO_2,9MnO,4Fe_2O_3,3(Ca,Mg,Ba)O$, or more simply, $9Mn_2O_3,4Fe_2O_3,MnO_2,3CaO$.

Juddite is a manganiferous amphibole occurring in association with the manganiferous pyroxene blanfordite (Abstr., 1907, ii, 701) at Kácharwáhi in the Nágpur district. It is distinguished by its very strong pleochroism—carmine, blue or green, and orange. L. J. S.

Stanniferous Rutile from Vaux (Rhône). GEORGES FRIEDEL and GRANDJEAN (*Bull. Soc. franç. Min.*, 1909, **32**, 52—54).—Small crystals, forming an accessory constituent of a very fine-grained biotite-schist, have D 4·238, and contain 1·75% SnO_2 and (approximately) 98·9% TiO_2. The amount of tin present in the rock itself is 0·0095%, corresponding with 0·54% of stanniferous rutile. L. J. S.

Crystalline Form of Conichalcite. LÉOPOLD MICHEL (*Bull. Soc. franç. Min.*, 1909, **32**, 50—51).—Crystals of this rare mineral have not previously been found. Material from the veins of copper ore (copper-pyrites, malachite, etc.) at Maya-Tass in province Akmolinsk, western Siberia, presents a crystalline structure, and cavities are lined with minute, indistinct crystals. The optical characters point to orthorhombic symmetry. Analysis gave:

As_2O_5.	P_2O_5.	CuO.	CaO.	Fe_2O_3.	MgO.	H_2O.	Total.	Sp. gr.
36·40	1·30	31·55	23·10	0·40	1·90	5·15	99·80	4·15

L. J. S.

Artificial and Natural Hydrated Calcium Carbonates. Peter N. Tschirwinsky (*Zeitsch. Kryst. Min.*, 1909, 46, 302—303; from *Ann. Géol. min. Russie,* 1906, 8, 238—244; *deutsch. Rés.*, 245—249).—The paper of L. L. Iwanoff (*tom. cit.*, 23—25) on the occurrence of hydrocalcite in the neighbourhood of Novo-Alexandria is criticised, and a review is given of the knowledge of the hydrated forms of calcium carbonate. Only three of these, namely, $CaCO_3,3H_2O$, $CaCO_3,5H_2O$, and $CaCO_3,6H_2O$, are regarded as being definitely established, and of these only the first two, distinguished respectively as trihydrocalcite and pentahydrocalcite, are known as minerals. One of the forms described by Iwanoff appears to be a monoclinic or triclinic form of anhydrous calcium carbonate with D 2·626.

L. J. S.

Pyromorphite from Rhenish Prussia. Rheinhard Brauns (*Centr. Min.*, 1909, 257—264).—A description is given of material from several mines in the neighbourhood of Rheinbreitbach. Dark brown crystals ($a:c = 1:0·72926$) from Ägidienberg gave on analysis: PbO, 81·88; P_2O_5, 15·80; Cl, 2·53 = 100·21. L. J. S.

Phenacite from Brazil. Eugen Hussak (*Centr. Min.*, 1909, 268—270).—Considerable numbers of perfectly colourless and transparent crystals of phenacite have recently been found in a gold mine at San Miguel de Piracicaba, in Minas Geraes; they measure up to 6 cm. across, and are of a flat, rhombohedral habit with numerous bright faces; D 2·97. They occur in a pegmatite-vein together with amazon-stone, quartz, mica, tourmaline, columbite, monazite, xenotime, etc. The xenotime has the form of cubes, being bounded by the tetragonal prism and the basal plane; analysis by G. Florence gave:

P_2O_5.	Y_2O_3, etc.	$Al_2O_3 + Gl_2O_3$.	SiO_2.	Total.	Sp. gr.
33·21	62·62	3·05	1·41	100·29	4·4

L. J. S.

Sardinian Minerals: Mimetite from the Cupriferous Strata of Bena (d)e Padru (Oziori). Aurelio Serra (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 361—363).—In these strata, the author finds two varieties of mimetite: one yellow and more frequent, and the other, colourless or white, which occurs rarely. The yellow variety has the composition:

$PbCl_2$.	PbO.	As_2O_5.	P_2O_5.	Total.
9·02	67·83	22·89	0·29	100·03

which corresponds with the formula $3[Pb_3(AsO_4)_2],PbCl_2$, and the axial ratio of the crystals is $a:c=1:0\cdot72840$. The angle $(10\bar{1}1):(0001)$ varies in magnitude with the chlorine-content of the mineral, its value being (1) 40°4′ for the yellow variety, which contains 2·30% Cl, and (2) 39°52′ for the white variety, containing 2·44% Cl. T. H. P.

Weathering Processes. Konstantin D. Glinka (*Zeitsch. Kryst. Min.*, 1909, **46**, 283—287; from *Trav. Soc. Nat. St. Pétersbourg*, 1906, **34**, 1—175; *deutsch Rés.*, 175—178).—A detailed study was made of the action of weathering processes on silicates, more especially of alumino-silicates, not only in the surface soil, but also in the sub-soil where humus is absent. Numerous analyses are given of various rock-forming minerals and zeolites and of their weathering products. Experiments were also made to determine the action of water, carbonated water, dilute acid solutions, and humus acid solutions on these minerals. It is shown that one and the same mineral may give rise to different products according to the conditions of weathering to which it has been subjected, the presence or absence of humus acid being of importance in this direction. L. J. S.

Allophane from Abbey Wood, Kent. R. H. Chandler (*Geol. Mag.*, 1909, [v], **6**, 222—223).—A considerable amount of allophane was found in a denehole at Abbey Wood near Woolwich; it forms a seam between the Thanet Sand and the Chalk, and along a fault fissure extends downwards into the Chalk. The material is cream or buff-coloured and friable. Analysis by J. L. Foucar gave:

SiO_2.	Al_2O_3.	CaO.	Fe.	H_2O (at 100°).	Loss on ignition (H_2O+CO_2).	Total.
28·80	23·52	2·45	trace	23·19	20·77	98·73

L. J. S.

Studies of Garnet. Max [Paul Wilhelm] Seebach (*Zeitsch. Kryst. Min.*, 1909, **46**, 312—315; from *Inaug. Diss.*, *Heidelberg*, 1906, 1—64).—The following varieties of garnet were examined with a view to determining how far the material, after fusion, is decomposed by hydrochloric acid. For the complete analyses the material was decomposed by fusion with boron trioxide. Determinations were also made of the sp. gr. and the refractive indices of the material both before and after fusion. Melanite from Frascati (anal. I—IV), after fusion, is not completely decomposed by hydrochloric acid. Demantoid from Polewskoi Zawod, Urals (V and VI); also not completely decomposed. Pyrope from Meronitz, Bohemia (VII and VIII); over 16% is insoluble in hydrochloric acid; the fused material in this case was not an isotropic glass, but contained octahedra, probably of chromite, set in a birefringent ground-mass. Pyrope from Colorado River, Arizona (IX and X). Almandine from Ceylon (XI and XII) fuses to a black, strongly magnetic glass, of which about 28% is not decomposed by acid; the isotropic glass contains skeletal crystals, probably of magnetite. Almandine from Jeypur, India (XIII and XIV); 26% insoluble.

Andradite from Dognaczka, Hungary (XV and XVI); the crystals show a zonal structure with isotropic and birefringent bands; the fused glass is practically all decomposed by hydrochloric acid. Grossular from Xalostoc, Mexico (XVII and XVIII); completely decomposed.

	SiO_2.	TiO_2	Al_2O_3.	Fe_2O_3.	Cr_2O_3.	FeO.	MnO.	CaO.	MgO.	Total.	Sp. gr.	Sp. gr. after fusion.
I.	34·47	2·63	5·56	21·31	—	1·99	0·56	32·01	1·66	100·29	3·774	3·263
II.	34·98	1·47	5·29	22·36	—	1·99	0·56	32·83	1·49	100·97		
III.	34·21	2·04	5·74	21·90	—	1·99	0·60	32·93	0·98	100·39		
IV.	35·29	—	5·17	22·22	—	1·99	0·78	32·59	0·14	99·91*		
V.	35·44	—	1·63	28·80	1·36	0·52	0·29	32·18	0·16	100·38	3·801	3·335
VI.	35·30	—	1·45	28·98	1·29	0·52	0·38	32·34	0·25	100·51		
VII.	42·94	—	21·43	1·00	1·97	7·80	0·47	4·42	20·52	100·55	3·679	3·251
VIII.	43·02	—	21·24	0·90	2·15	7·80	0·53	4·52	20·82	100·98		
IX.	43·29	—	20·87	—	2·50	10·21	0·58	4·62	18·26	100·33	3·715	3·190
X.	43·45	—	21·12	—	2·21	10·21	0·46	4·45	18·58	100·48		
XI.	37·34	—	19·39	3·37	—	35·45	1·29	2·42	1·20	100·46†	4·040	3·09
XII.	37·16	—	19·47	3·21	—	35·45	1·18	2·59	1·06	100·12		
XIII.	38·11	—	19·56	2·13	—	31·58	1·40	5·11	2·80	100·69	4·025	3·240
XIV.	38·03	—	19·70	2·19	—	31·58	1·31	4·95	2·73	100·49		
XV.	36·74	—	1·51	29·19	—	0·69	0·29	31·41	0·69	100·52	3·600	3·171
XVI.	36·84	—	1·27	29·41	—	0·69	0·23	31·38	0·85	100·67		
XVII.	40·75	—	21·62	0·21	—	0·43	1·18	35·52	0·30	100·42‡	3·506	2·866
XVIII.	40·82	—	21·78	0·15	—	0·43	0·95	35·73	0·48	100·74‖		

* Including K_2O. 0·14. † Na_2O, trace.

‡ Loss on ignition, 0·41. ‖ Loss on ignition, 0·40.

The fusing of garnets is thus accompanied by a decrease in sp. gr. of 12·5—20%, and the refactive indices are also lowered by 4·2—6·6%.

L. J. S.

Basalts from the Plateau Round Tiesi, Northern Sardinia. AURELIO SERRA (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 399—405).—The author describes various samples of basalt from different points of the plateau surrounding Tiesi.

(1) From Monto Santo.—The fundamental mass consists of slender, felspathic strips, embedded in which are crystals of labradorite, olivine, delessite, augite, apatite, ilmenite, and magnetite. Its chemical composition is:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	TiO_2.	P_2O_5.	CaO.
53·15	24·47	1·40	3·60	0·32	0·60	0·56	6·83

MgO.	K_2O.	Na_2O.	H_2O (at 110°).	H_2O (at red heat).	Total.
1·22	2·59	4·97	0·20	0·57	100·48

These results correspond with $1·3RO,R_2O_3,3·80SiO_2$; $R_2O : RO = 1 : 1·99$.

(2) From Monte Pelao.—The stripy felspar exhibits inclusions of labradorite, olivine, augite, hypersthene, magnetite, apatite, and granules of oxidised iron formed by alteration of the olivine and magnetite. The composition is:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	TiO_2.	P_2O_5.	CaO.
53·36	23·17	1·92	3·34	0·48	0·59	0·60	7·31

MgO.	K_2O.	Na_2O.	H_2O (at 110°).	H_2O (at red heat).	Total.
0·89	3·08	4·62	0·55	0·83	100·77

These numbers lead to the formula: $1·6RO,R_2O_3,3·94SiO_2$; $R_2O : RO = 1 : 2·3$.

(3) From Monte Giave.—The matrix consists of small microliths of felspar containing crystals of plagioclase, augite, and olivine, and small granules of magnetite. Analysis gives the following results:

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	TiO_2.	P_2O_5.	CaO.
52·14	21·89	1·74	3·50	0·40	0·51	0·77	9·16

MgO.	K_2O.	Na_2O.	H_2O (at 110°).	H_2O (at red heat).	Total.
2·81	2·34	4·15	0·32	0·93	100·66

the formula being $1·8RO,R_2O_3,4·08SiO_2$.

These rocks are more acid, and contain more alkali, than the mean of 19 basalts examined by Loewinson-Lessing (Studien über Eruptivgesteine, Internat. Geol. Cong., St. Petersburg, 1899, 193—461), the mean formula being $2·64RO,R_2O_3,4·63SiO_2$; $R_2O : RO = 1 : 7·85$. The rocks examined by the author are evidently intermediate to the andesites and basalts, and approximate the more nearly to the former class. They differ considerably from the more recent eruptive rocks of Northern Sardinia (compare this vol., ii, 156), the mean formula for which is: $1·9RO,R_2O_3,4·09SiO_2$. T. H. P.

Chemical Composition of the Deposits from the Thermal Waters of Uriage (Isère). GUSTAVE MASSOL (*Bull. Soc. chim.*, 1909, [iv], 5, 404—405. Compare Abstr., 1908, ii, 1004).—The waters of the thermal spring of Uriage deposit on cooling a pale yellowish-grey solid, soft and oily to the touch, and consisting of sulphur, 56·4%; mineral matter, 35·94%; organic matter, 6·44%, and moisture, 1·22%. The sulphur is almost entirely soluble in carbon disulphide; the organic matter contains nitrogen; the mineral matter is composed chiefly of silicic acid, and, in addition to the elements calcium, magnesium, and arsenic found by Lefort, contains also zinc, manganese, lead, and copper.
M. A. W.

Physiological Chemistry.

Biological Oxidation. CARL ENGLER and REGINALD O. HERZOG (*Zeitsch. physiol. Chem.*, 1909, 59, 327—375).—A discussion mainly historical and theoretical of the knowledge of oxidation in the body. The organism takes in gaseous oxygen, and the first phase of its action is an auto-oxidation with the formation of additive compounds of the autoxidisable substances with a molecule of oxygen, for which the name *moloxides* is suggested; the action of peroxides on "acceptors," and the part played by oxydases are also considered. The oxydases are regarded as enzymes in the sense of catalytic agents. W. D. H.

The Partition of the Sugar in Blood. Adolf Hollinger (*Biochem. Zeitsch.*, 1909, 17, 1—12).—In normal circumstances the fluid and corpuscular portions of the blood contain about the same amount of sugar. In the majority of cases of hyperglycæmia, the amount in the corpuscles increases more than that in the plasma. It is therefore necessary in every case to make an estimation in the whole blood. W. D. H.

Enzyme Concentration in Saliva. J. G. Ryan (*Amer. J. Physiol.*, 1909, 24, 234—243).—The rabbit's submaxillary saliva contains no diastase; the parotid saliva contains about the same concentration of ptyalin as human parotid saliva, but cases are found where the enzyme is absent both in the parotid saliva and serum of rabbits. Most ptyalin is obtained in saliva obtained by stimulating the cervical sympathetic nerve, or by lessening the blood supply of the gland. During prolonged secretion, the ptyalin concentration falls off and may reach zero. The same is probably true for enzyme concentration in other secretions.

W. D. H.

Enterokinase in Infancy. Arthur E. Austin (*Proc. Amer. Soc. Biol. Chem.*, 1908, viii—ix; *J. Biol. Chem.*, 6).—Extracts of the pancreas of infants, from twenty-four days of age onwards, contained trypsin at least partly activated. The intestinal mucous membrane of the same children, irrespective of age or cause of death, contained enterokinase. No antikinase was discovered. W. D. H.

Human Pancreatic Juice. Harold C. Bradley (*J. Biol. Chem.*, 1909, 6, 133—172).—Owing to an accident followed by an operation, the opportunity occurred of obtaining for some time a supply of human pancreatic juice. Its specific gravity was about 1·010; its alkalinity varied from a $N/10$ to a $N/20$ sodium hydrogen carbonate solution. No definite relation occurred between diet and enzyme content. The amount of enzymes varies a good deal, except amylopsin, which was fairly constant from day to day. When excreted slowly, the juice is more concentrated in total solids, carbonates, and lipase. Rennin, invertase, and lactase were not found. Neither manganous sulphate nor bile accelerated its power to digest starch. Trypsin was found in about half the samples; the inactive samples became gradually active after a time, even in the presence of toluene or chloroform. Activation was rapidly brought about by enterokinase. Saponification, both of olive oil and of ethyl butyrate, varied in a parallel way in the different samples; probably a single enzyme is concerned in both cases. Bile exercises a two-fold influence on the digestion of olive oil: it assists emulsification, and protects the enzyme from the inhibitory action of the acid liberated. The effect on the digestion of ethyl butyrate is more complex; it inhibits or accelerates according to its concentration.

The hydrolysis of olive oil proceeds at first as an autocatalytic reaction. This may be due to soap formation and consequent emulsification. At certain stages there is a constant relation between the amount of acid liberated and the time of the reaction. Continuous shaking inhibits the reaction. This may be due to air bubbles diminishing the surface contact between zymolite and enzyme. Up to

30°, rise of temperature increases the reaction, and above that inhibition occurs by an increase in the inhibitory effect of the oleic acid; at 50°, the enzyme is weakened, and about 60°, it is destroyed.

W. D. H.

Activation of Pancreatic Juice. Barbara Ayrton (*Quart. J. Exp. Physiol.*, 1909, 2, 201—217).—Pancreatic trypsinogen may be activated by enterokinase, and also by calcium salts, probably by chemical action. The spontaneous activation which occurs when the juice is kept free from the enterokinase is mainly due to the presence of calcium salts in the juice. But some other factor is present, for, after decalcification, addition of calcium salts does not produce activation. Excess of calcium salts inhibits activation. Spontaneous activation is accelerated by heat; the calcium reaction of the juice is not affected by changes of temperature under 40°; activation by enterokinase is retarded at 35°, as the enzyme is destroyed by that temperature in an alkaline medium; in a neutral medium, elevation of temperatures quickens activation. W. D. H.

Action of Electrolytes on the Hydrolysis of Fats by the Pancreatic Secretion. Émile F. Terroine (*Compt. rend.*, 1909, 148, 1215—1218).—Experiments are described bearing on the influence exerted by the sodium halides, and by the chlorides of calcium, barium, and magnesium, on the pancreatic hydrolysis of fats. The experiments do not support the view that these salts accelerate digestion by facilitating the formation of fatty emulsions.

W. O. W.

Metabolism of a Breast-fed Infant. Samuel Amberg and W. P. Morrill (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxv—xxxvi; *J. Biol. Chem.*, 6).—Details are given of the nitrogenous metabolism in an infant a month old, for two periods in which it received different amounts of milk. The retention of nitrogen decreased with advance in age. The ammonia coefficient is not so much dependent on the amounts of protein and fat in the food as on the ratio between them. In the first period the fat : protein ratio was 3·2 : 1, and the ammonia coefficient, 8·1%; in the second period, on a scantier diet, the F:P ratio was 5·1 : 1, and the ammonia coefficient, 18·3%. W. D. H.

Influence of Salicylic Acid and its Isomerides on Metabolism. Elbert W. Rockwood (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxv; *J. Biol. Chem.*, 6).—In a purine-free diet in man, the ortho-compound increases the output of uric acid, possibly because it inhibits the uricolytic enzyme. *m*- and *p*-Hydroxybenzoic acids have no such effect. W. D. H.

The Transfer of Protein in Inanition. Albert Woelfel (*J. Biol. Chem.*, 1909, 6, 189—201).—It is well known that in inanition certain organs, such as the brain and heart, are nourished at the expense of less important organs. This suggests that the same may occur even when food is taken, and the suggestion occurred that a

difference in the autolysis of some tissues might account for their lability and the transfer of protein to other tissues. A large number of autolysis experiments are recorded in detail which, although of interest in themselves, did not solve the problem, nor do they entirely exclude the suggestion mentioned. Among the points made is this: the blood-free tissues from fasting animals show no marked difference in autolytic properties from normal tissues, hence there is no evidence of increased autolysis, or diminution of anti-enzymes in starvation.
W. D. H.

The Physiological Protein Minimum. Louis Michaud (*Zeitsch physiol. Chem.*, 1909, **59**, 405—491).—A point hitherto neglected in considering the effect of giving to a starving animal the same amount of protein as it loses during inanition, is the kind of protein used. A mere nitrogen estimation in the food-protein is insufficient; the proportion between the cleavage products is important. It is shown by experiments on dogs that a protein foreign to the body, such as edestin, will not produce equilibrium if given in quantity equal to the protein lost during inanition, but this can be accomplished if protein obtained from dog's muscle, blood, and other organs is administered; horse flesh or casein are not so readily built into the dog's organism. By alternate periods of feeding and inanition, the protein minimum is reached in a staircase-like manner until it reaches 0·1 gram nitrogen per kilo. of body-weight. W. D. H.

Fat Absorption. R. H. Whitehead (*Amer. J. Physiol.*, 1909, **24**, 294—296).—If cats are fed on fat coloured with Sudan-red III, the globules found after absorption in the villi are uncoloured. This is additional evidence in favour of the view now generally held that fat-splitting occurs before fat products are absorbed by the intestine.
W. D. H.

Absorption of Phenol from the Alimentary Canal. Paul Hanzlik and Torald Sollmann (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxvii; *J. Biol. Chem.*, **6**).—If concentrated phenol is introduced into the stomach or intestine of cats and dogs in the dose of 1 gram per kilo. of body-weight, about 38% is absorbed within five minutes, and then absorption completely ceases; the cause of the arrest is not clear, for it is stated not to be due to corrosion, or local injury, or low blood-pressure, or re-excretion, or to a greater solubility in the gastric contents.
W. D. H.

The Fats of Hens' Eggs. Raffaele Paladino (*Biochem. Zeitsch.*, 1909, **17**, 356—360).—The yolk of hens' eggs contains both liquid and solid fats, amongst the products of hydrolysis of which were oleic, palmitic, and stearic acids. Phosphoric acid, iron, and sulphur were also found. Formic acid was probably also present. S. B. S.

Origin and Destiny of Cholesterol in Animals. III. Absorption of Cholesterol. Charles Dorée and John A. Gardner. **IV. Cholesterol of Eggs and Chicks.** G. W. Ellis and John A. Gardner (*Proc. Roy. Soc.*, 1909, *B*, **81**, 109—128, 129—132. Compare Abstr., 1908, 514).—Consideration of the previous work of the authors and of others appears to show that some of the cholesterol of the bile is the débris of blood-corpuscles and other cells; this cholesterol is, however, re-absorbed and used in the making of new cells; the fæces of herbivora is free from cholesterol, and in carnivora, the fæcal cholesterol is accounted for by that in the food, which may on certain diets be partly converted into coprosterol. There is, however, wastage of cholesterol through the skin, and the question arises how this is made good. Feeding experiments were therefore undertaken, and in rabbits considerable absorption of cholesterol added to the food occurs, and the percentage in the blood rises. In cats a difficulty arose in not at first being able to devise a diet free from cholesterol, and so the results are not so clear. This difficulty has now been overcome and further work promised. In the experiments on eggs and chicks, no synthesis of cholesterol was found to occur during embryonic development. W. D. H.

A Mono-aminodiphosphatide in Egg-Yolk. HUGH MACLEAN (*Bio-Chem. J.*, 1909, 4, 168—174).—The ethereal extract of egg-yolk contains ordinary lecithin, and also a mono-aminodiphosphatide which is somewhat different from the cuorin of heart-muscle. The difference probably depends on the presence of different fatty-acid radicles. The ethereal extract also contains pure tripalmitin. W. D. H.

Globulins of Egg-Yolk of Selachians. CARL L. ALSBERG (*Proc. Amer. Soc. Biol. Chem.*, 1908, xiii; *J. Biol. Chem.*, 6).—The ovarian eggs of the skate contain a characteristic vitellin, but in the eggs of the spiny dogfish none could be found. As the skate is oviparous and the dogfish viviparous, this may have a biological significance.
W. D. H.

Chemical Analysis of Brain. WALDEMAR KOCH and SYDNEY A. MANN (*Arch. Neurol. and Psychiat. London County Council*, 1909, 4, 174—219).—The methods employed for the separation and estimation of the numerous constituents of nervous material are described with some fulness. As the brain grows, there is a decrease in the proportion of moisture, proteins, extractives, and ash, and an increase in the galactosides, lipoids, and cholesterol. There is an increase in lipoid sulphur and phosphorus, but a decrease in neutral and inorganic sulphur and extractive phosphorus. A comparison of the human brain with that of other animals is deferred. In non-nervous disease the variations from the normal are unimportant. Examination of the brain in cases of dementia præcox confirm those previously published (Abstr., 1908, ii, 52). In general paralysis, the destructive disease attacks the brain tissue as a whole, but the phosphatides appear to be the most readily destroyed constituents. The change in the neutral sulphur content which occurs in dementia præcox is not seen in general paralysis. W. D. H.

Influence of Age on the Quantity and Chemical Distribution of Phosphorus in Nerves. CHARLES DHÉRÉ and H. MAURICE (*Compt. rend.*, 1909, 148, 1124—1125).—Determinations have been made of the amount of phosphorus in the dried peripheral nerves of dogs varying in age from four weeks to eight years. It is found that the total phosphorus diminishes as the age increases; the same is true of the lipoid, nucleic, and inorganic phosphorus, although to a different extent in each case. When the amount of phosphorus in these states of combination is expressed as a fraction of the total phosphorus, it is found that whilst the proportion of inorganic phosphorus diminishes, the proportion of lipoid and nucleic phosphorus increases with age.

W. O. W.

The Potassium in Cerebro-spinal Fluid. VICTOR C. MYERS (*J. Biol. Chem.*, 1909, 6, 115—131).—The cerebro-spinal fluid alters rapidly after death, probably owing to changes in the permeability of the cell wall in nervous structures; this especially leads to a rise in potassium, and occurs in health and disease. In degenerative nervous diseases, the amount of potassium in the fluid is not increased during life. There is a similar increase in the phosphates after death. Sulphates are present in the merest traces both during life and after death. The sugar in the fluid usually disappears after death. The proteins are increased in dementia paralytica during life. The occurrence of choline was not investigated. W. D. H.

Effect of Salts on the Frog's Heart. F. C. COOK (*Amer. J. Physiol.*, 1909, 24, 263—268).—From a small number of experiments, the conclusions are drawn that nitrites in small doses slightly stimulate the heart, and that certain nitrates have a similar effect. The sulphates (except those of iron and hydrogen) increase the heart's rate, and chlorides produce the same result, except those of strontium and potassium. W. D. H.

Retention of Alkali by the Kidney. LAWRENCE J. HENDERSON and H. M. ADLER (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxviii—xxxix; *J. Biol. Chem.*, 6).—Urine is treated with potassium oxalate, filtered, diluted, and titrated with decinormal sodium hydroxide, using neutral-red as indicator. The end point is found by matching the colour with that given by a standard phosphate solution possessing the same reaction as blood. The result of the titration *plus* the urinary ammonia measures the alkali retention. W. D. H.

The Action of Gases on Autolysis, with Special Reference to their Action on Metabolism. ERNST LAQUEUR (*Schrift. Physikal. ökonom. Ges. Königsberg*, 1909, 1; Reprint).—Under certain conditions in life, when an oxygen deficiency and excess of carbon dioxide occur in the organism, an increased nitrogen excretion as compared with the normal takes place. The author shows that oxygen inhibits autolysis, whereas carbon dioxide increases it. Carbonic acid, like all other acids, increases autolysis, but it appears to have a specifically powerful effect as compared with others. S. B. S.

The Action of Arsenic on Autolysis. ERNST LAQUEUR (*Schrift. Physikal. okonom. Ges. Königsberg*, 1907, 48; Reprint).—Kossel has shown that administration of arsenic and sodium arsenite to dogs increases nitrogen excretion. Nevertheless, these substances inhibit autolysis of the liver. S. B. S.

The Influence of Inorganic Colloids on Autolysis. VI. The Differences of Action of Various Hydrosols. M. Ascoli and G. Izar (*Biochem. Zeitsch.*, 1909, **17**, 361—394. Compare Abstr., 1908, ii, 121, 713).—The rate of autolysis of ox-liver in presence of varying quantities of different colloids was investigated, and in each case the following determinations were made: total nitrogen, nitrogen of monoamino-acids, of purine bases, and of albumose. It was found that the formation of monoamino-acids in autolysis was influenced in the same way as the total autolysis. Scission of nucleins, however, was promoted by smaller quantities of a colloid than were necessary to markedly influence the total autolysis. The favouring action of the colloids on autolysis reaches an optimum with certain concentrations of the colloid, but above this concentration the colloid exerts an inhibitory influence. There are quantitative differences in the action of the various colloids, and in a few instances also qualitative differences, certain of the colloids having actions somewhat divergent from those above mentioned. S. B. S.

Adsorption and Partial Purification of Catalase from the Liver. Amos W. Peters and H. W. Stewart (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxx—xxxi; *J. Biol. Chem.*, **6**)—The aqueous extract of liver is treated with sodium phosphate and zinc sulphate. The precipitated zinc phosphate is heavily charged with catalase, which is removed with sodium phosphate and further purified by the same process of adsorption. The catalase so prepared gives a strong xanthoproteic reaction, but practically negative Millon's and biuret reactions. It is inactivated by boiling. W. D. H.

Post-Mortem Glycogenolysis. John J. R. MacLeod (*Proc. Amer. Soc. Biol. Chem.*, 1908, xl—xli; *J. Biol. Chem.*, **6**).—Glycogen in the dog's liver is unevenly distributed in the various lobes. If the liver is removed before death, the amount of glycogen is less than immediately after death, probably because in the former case the liver contains more blood. Glycogenolysis is quite slow immediately after death, and later is rapid. If the great splanchnic nerve is stimulated in the bloodless liver, the rate of glycogenolysis is more than doubled. The glycogenolytic fibres in this nerve are therefore independent of the vaso-motor fibres. W. D. H.

Action of Phloridzin on the Liver. Karl Grube (*Pflüger's Archiv*, 1909, **128**, 118—124).—By the simultaneous perfusion of dextrose and phloridzin through the liver, no increase of glycogen occurs in that organ such as takes place when dextrose alone is perfused. It may be that glycogen is formed, but this is masked by the energetic hydrolysis which follows its formation. Under the influence of phloridzin the glycogen already present in the liver decreases; this is not due to a simple washing out, for the lobe of the liver simultaneously perfused with Ringer's solution shows no such marked decrease. The glycogen in the phloridzin lobe is from 21 to 54% less than in the other. That the glycogen is changed into sugar is regarded as probable, but the point was not specially investigated. Phloridzin acts directly on the liver cells. W. D. H.

Chemico-physical Investigations on the Crystalline Lens. VI. Imbibition of the Lens in Sodium Chloride Solutions of Various Concentrations. Filippo Bottazzi and Noè Scalinci (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 326—338, 379—384. Compare this vol., ii, 417).—Even in very dilute sodium chloride solutions ($0{\cdot}0008N$) the imbibition of the crystalline lens is much less than in distilled water. This is the reverse of what occurs with gelatin or agar-agar, probably owing to the facts that the lens is impregnated to some extent with sodium chloride solution, and that the imbibition is accompanied by osmotic processes. The solution in equilibrium with the lens contains about 1·3% of sodium chloride.

In the more concentrated solutions ($0{\cdot}341$—$2{\cdot}393N$) of sodium chloride, the lens loses in the first hour 1·35—4·93% of its weight. With such solutions, there are three distinct periods, in which (1) the lens diminishes in weight continuously, reaching more or less rapidly a minimum; (2) the diminution in weight gradually disappears, the initial weight being attained, and (3) continuous increase in weight takes place. The more concentrated the solution the more rapidly do those periods succeed one another, the rapidity increasing more rapidly than the concentration.

The diminutions in weight which the lens undergoes in the concentrated solutions are small compared with the increases in weight in the dilute solutions in the same time, so that the lens is more inclined to take up water, increase in weight, and swell than it is to lose water, diminish in weight, and contract.

Prolonged immersion of two lenses in $0{\cdot}834$ and $1{\cdot}709N$-sodium chloride solutions shows that in the third period, after the lenses have first lost weight and then recovered it, increase in weight takes place only until a maximum is reached, the weight then oscillating about this maximum for some hours. There is thus an apparent tendency to arrive at an equilibrium between the force of imbibition of the body of the lens which tends to attract solution and the elastic tension of the capsule, the opposition of which to the entry of liquid increases with the volume of liquid penetrating it.

Immersion of lenses in water vapour of varying pressures at 38° shows that, no matter what the vapour pressure, disimbibition of the lens always takes place to about the same extent. When the capsule of the lens is removed, similar behaviour is observed, and, if the immersion is prolonged, the distillation of water from the lens to the liquid is continuous. T. H. P.

Autolytic Formation of Lactic Acid in Muscles. R. S. Frew (*Zeitsch. physiol. Chem.*, 1909, 60, 15—19).—Fresh rabbit's muscle sometimes contains lactic acid (4 cases), sometimes not (3 cases). By short digestion in chloroform water, no formation of lactic acid occurred in 3 cases; in one case there was a positive result. By prolonged digestion there is a decrease in the lactic acid, so there seems to be present an agent which destroys the acid, probably of the nature of an enzyme. The amount of water of crystallisation in the zinc salt shows that the acid is of the dextrorotatory variety, but on putrefaction there is generally a mixture. W. D. H.

Influence of Cold Storage on Flesh. A. D. Emmett and Harry S. Grindley (*Proc. Amer. Soc. Biol. Chem.*, 1908, ix—x; *J. Biol. Chem.* 6)—Three weeks cold storage causes no loss of water or protein in beef and chicken, an increase in soluble inorganic phosphates, and a decrease in non-protein nitrogen. Six weeks cold storage causes a slight loss of water, no further increase in phosphates, and an increase in extractives and soluble nitrogen. Cold storage meat loses less in cooking, and is juicier. W. D.H.

Diastatic Enzyme of Meat. Amos W. Peters and H. A. Mattill (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxix—xxx; *J. Biol. Chem.*, 6).—During autolysis of muscle, the sugar obtained increases so long as the muscle remains edible; later the sugar diminishes, and finally vanishes. W. D. H.

Pharmacological Actions of the Placenta. S. Higuchi (*Biochem. Zeitsch*, 1909, 17, 21—67).—The normal human placenta contains neither a toxin nor any substances of the nature of ergot, adrenaline, or saponin. It, however, contains enzymes which decompose hydrolytically many glucosides and esters, in some instances more powerfully than extracts of other animal organs. Any similar action on alkaloids is only exerted in small measure. W. D. H.

Physiology of Glands. XI. The Functions of the Spleen. Leon Asher and Hans Grossenbacher (*Biochem. Zeitsch.*, 1909, 17, 78—119).—The amount of iron in the fæces has no relation to the total amount of fæces. The daily excretion of iron in dogs from which the spleen has been removed is much greater than in normal dogs (29·2 to 12·2 mg. a day). This is not due to lessened absorption, for the same is seen during inanition and in well-fed animals. The same phenomenon goes on five months after the operation. The spleen, therefore, plays a part in iron metabolism, enabling the body to retain and utilise it. W. D. H.

The Physiology of Glands. XII. The Function of the Spleen in Iron Metabolism. Leon Asher and Richard Zimmermann (*Biochem. Zeitsch.*, 1909, 17, 297—336. Compare this vol., ii, 163).—Dogs, even ten to eleven months after splenectomy, excrete more iron than normal animals. This difference between the excretion of iron in normal dogs and dogs without spleen is not much influenced by subcutaneous injection, and the spleen has but little significance on the utilisation of iron artificially introduced. After injection of acetylphenylhydrazine, which causes a destruction of blood-corpuscles, there is a slightly increased iron excretion in the splenectomised as compared with the normal dog. On the other hand, in starving dogs, where iron is derived from the breakdown of body proteins, the increased excretion in dogs without spleen is marked as compared with that of normal animals. The experiments confirm Ascher's theory that the spleen is capable of causing the utilisation of iron derived from the breakdown of the tissue proteins. S. B. S.

The Iron of the Spleen. CESARE CAPEZZUOLI (*Zeitsch. physiol. Chem.*, 1909, 60, 10—14).—In ox spleen an iron-containing nucleo-protein is present; it contains 2·32—2·68% of phosphorus. It dissolves in boiling water with some difficulty; the percentage of iron in the nucleo-protein obtained by the first extraction with boiling water is 1·48—2·0, and by the second, 0·41—0·97. The filtrate still, however, contains a variable amount of iron, about 20—25% of the total.
W. D. H.

Neurine, a Constituent of the Suprarenal Gland. ALFRED LOHMANN (*Pflüger's Archiv*, 1909, 128, 142—144).—In addition to adrenaline, choline, and other bases previously separated from the suprarenal body, neurine is also present. It was separated as the aurichloride, and gave the chemical characters and physiological action of neurine. W. D. H.

Determination of Iodine in Protein Combinations. LOUIS W. RIGGS. **Absorption of Iodine by the Dog's Thyroid.** ELEANOR VAN ALSTYNE and S. P. BEEBE. **Iodine in Human Thyroids.** LOUIS W. RIGGS and S. P. BEEBE (*Proc. Amer. Soc. Biol. Chem.*, 1908, xli, xli, xli—xlii; *J. Biol. Chem.*, 6).—Improvements in Baumann's process are suggested. In young dogs there is a maximum capacity for iodine absorption in the thyroid; this lessens with age, and in old animals it may reach zero. In the human thyroid the average quantity of iodine is 0·33 mg. per gram of fresh gland. Some cases gave higher numbers, but probably iodine had been given to those patients medicinally. In exophthalmic goitre, the average figure was much less (0·08). Other pathological thyroids gave very variable numbers. W. D. H.

Phosphatides in Animal and Vegetable Materials. HANS VAGELER (*Biochem. Zeitsch.*, 1909, 17, 189—219).—From numerous analyses which are given, the phosphatides appear to be bound up with vital manifestations in plant life. The percentage present increases with development, and then decreases after maturity sets in. An analogous condition obtains in animal metabolism. They are characterised by their colloidal nature and readiness of oxidation, a process intimately associated with life. Methods for their sharp separation from one another are still largely lacking, and so it is impossible to state the relative importance of the different members of the group. Kyes' results on the part lecithin plays as an amboceptor are regarded as doubtful. W. D. H.

Origin of Taurocholic Acid. ROBERT B. GIBSON (*Proc. Amer. Soc. Biol. Chem.*, 1908, xvi; *J. Biol. Chem.*, 6). Experiments on cats are recorded which confirm the view of Bergmann and of Wohlgemuth that taurine originates from the cystine of protein. If bromobenzene is administered, artificial cystinuria is produced, and the consequent fall in the taurine of the bile was observed.

W. D. H.

Analysis of Vernix caseosa. I. Leo Ritter von Zumbusch (*Zeitsch. physiol. Chem.*, 1909, 59, 506—519. Compare Ruppel, Abstr., 1896, ii, 199).—The amount of water and of substances insoluble in ether vary considerably. The insoluble material consists mainly of epidermal cells. The ash does not contain phosphates. The fat which was extracted by ether gave the following numbers: D 0·9003, m. p. 34°, f. p. 29·2°, acid number 8·11, hydrolytic value 128·9, Reichert-Meissl number 0·720, and iodine number 47·42. Sixty-three grams of the fat gave 19 grams of fatty acids and 38 grams of non-hydrolysable matter soluble in ether. Another portion (120 grams) gave 40 grams of non-volatile fatty acids, 71 grams of non-hydrolysable cholesterol derivatives, and small amount of volatile acids (formic). The fatty acids contained 41·2% of oleic acid. The solid fatty acids are odourless, comparatively hard, and have m. p. 56·5°, f. p. 48°, and iodine number 25·84.

J. J. S.

The Enzymes of Milk. Fréd. Bordas and F. Touplain (*Compt. rend.*, 1909, 148, 1057—1059).—Fresh milk is differentiated from boiled milk by the coloration it gives with tincture of guaiacol or *p*-phenylenediamine. The action is a catalytic oxidation of the indicator, and has been supposed to be due to an enzyme of the *oxydase* class, termed *lactanacroxydase* by Dupuoy. By heating at 80°, the temperature at which enzymes are destroyed, the oxidising power of milk is lost. If, however, boiled milk is centrifugalised, both the cream and the solid residue give the colour, whilst casein extracted from fresh or boiled milk is found to give a very intense coloration. The authors reject the enzyme theory, and prefer to suppose that the reaction in question is brought about by casein or calcium caseinate. In boiled milk the casein proper is masked by a film of soluble casein deposited on the particles.

R. J. C.

The Ratio of Inorganic Bases to Acids in Normal Human Urine. Stanislas Kozłowski (*Bull. Acad. Sci. Cracow*, 1909, 37—45).—Four series of experiments were made, two on a diet consisting chiefly of meat, one on a mixed diet, and one on a milk diet. On a meat diet, the inorganic bases considerably exceed the quantity required to saturate the inorganic acids, uric acid, and organic acids soluble in ether. The balance must be considered as combined with proteic acids. On a milk diet, on the other hand, the inorganic bases are insufficient even to saturate the inorganic acids, although uric, proteic, and ether-soluble organic acids are also present. The balance must be saturated by organic bases, of which creatinine can only form a small part. The mixed diet gives an intermediate result, the inorganic bases approximately saturating the inorganic, uric, and ether-soluble acids, but not the proteic acids.

The acidity of urine is only remotely related to the production of

acids in the organism. It is not due to an increased production of inorganic or uric acids, and it cannot be entirely due to acid phosphates.
C. H. D.

Composition of Dilute Urine. Archibald B. Macallum and C. C. Benson (*J. Biol. Chem.*, 1909, 6, 87—104).—In dilute urine, obtained after drinking large amounts of distilled water, Δ ranges from $-0·30$ to $-0·075$; the proportion of potassium is usually greater than that in the more concentrated urine obtained before the experiment began, and is never the same as in blood-plasma. This is due to a "lag" in potassium secretion as compared with the chloride during the decrease in the concentration; the same "lag" is seen usually when the urine again begins to become more concentrated. The elimination of water and salts is due to activity of the renal epithelium, and is not a mere filtration.
W. D. H.

The Influence of Adrenaline on the Excretion of Carbon Dioxide and Urine. St. Welecki (*Bull. Acad. Sci. Cracow*, 1909, 119—124).—The injection of minute quantities of adrenaline into a vein causes an increase of blood-pressure in the main arterial system, but a decrease in the pulmonary arteries. Intraperitoneal injection causes an increase of pressure in both systems.

Experiments on dogs and rabbits show that intravenous injection of adrenaline causes an increase, and intraperitoneal injection a decrease, of the carbon dioxide excretion. In experiments on guinea-pigs, the quantity of urine was more than doubled after injections of adrenaline, the urine becoming more dilute, but the absolute quantity of dry substance and nitrogen being increased.
C. H. D.

Elimination of Barium. Gustave M. Meyer (*Proc. Amer. Soc. Biol. Chem.*, 1908, xlvii; *J. Biol. Chem.*, 6).—Barium bromide was given to dogs by the mouth and subcutaneously; by the former method, only traces appear in the urine, and by the latter, none at all was found in that excretion.
W. D. H.

Estimation of Amino-acids in Urine. Valdemar Henriques (*Zeitsch. physiol. Chem.*, 1909, 60, 1—9).—By means of Sörensen's method of titration with formaldehyde (Abstr., 1908, ii, 234), the amount of amino-acid nitrogen in urine can be estimated with great accuracy, and at the same time an estimation of ammonia nitrogen can be obtained. The amount of amino-acid nitrogen expressed in percentage terms of total nitrogen is in man on a mixed diet about 2; in the goat fed on hay about 0·7, and in the dog, numbers varying from 0·73 to 4·6 were obtained.
W. D. H.

Indole-producing Compounds of the Urine. Charles Porcher (*Compt. rend.*, 1909, 148, 1210—1212).—A discussion of the decomposition of tryptophan in the digestive tract of the higher animals, and of the appearance of its breakdown-products in the urine. The relative proportion of indole-producing compounds (indolepropionic acid, indoleacetic, indole-β-carboxylic acid, etc.) to indoxyl derivatives in the urine depends on the extent to which tryptophan has undergone proteolytic decomposition in the intestine.

W. O. W.

Metabolism in Dementia Præcox. Giacomo Pighini (*Arch. Neurol. and Psychiat. London County Council*, 1909, 4, 220—243).—This is a metabolic study of twelve cases of dementia præcox, four in the acute and eight in the more advanced stage of the disease. In all cases modifications of normal metabolism are seen. In the acute stage (that of restlessness and violence) there is a negative balance of nitrogen (urea, uric acid, purine bases), of phosphorus and sulphur, indicating increased catabolism of protein, and phosphorised and sulphurised constituents. The body temperature is also raised.

In the advanced stage (that of dementia) there is a proportionate retention of nitrogen and phosphorus, also of sulphur proportionate to those elements, and an independent loss of calcium. In both phases the intake and excretion of water is diminished, especially by the skin; it is difficult to get the patients to take fluid, and most of the water excreted passes off by the kidneys. There is a relaxed (*sic*) excretion of chlorides. W. D. H.

Intestinal Diabetes. Eduard Pflüger (*Pflüger's Archiv*, 1909, 128, 125—135).—Resection or even injury of the small intestine, especially of its outer and peritoneal layers, produces glycosuria, which is held to be of nervous origin. It continues for some days. Injury to the pancreas was excluded. W. D. H.

Destruction of Body-protein in Fever. Philip A. Shaffer (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxvii; *J. Biol. Chem.*, 6).—In typhoid fever the loss of body-protein may be retarded, or even prevented, by diets of high calorific value containing a large amount of carbohydrate. W. D. H.

The Large White or Soapy Kidney. Oskar Klotz (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxviii; *J. Biol. Chem.*, 6).—This pathological specimen contains less fat than the normal organ, but it contains excess of "myelins." By extraction with ether, and subsequent extraction of the ethereal extract with alcohol, the substance was obtained in solution and precipitated by chloroform. It proved to be a compound of two fatty acids (one of which is oleic), potassium, and sodium. The term soapy is therefore probably justified.

W. D. H.

Reaction of Blood-serum in Malignant Disease. W. N. West Watson (*J. Path. Bact.*, 1909, 13, 429—436).—The alkalinity of the serum to dimethylaminoazobenzene in malignant disease is markedly increased, and this is most noticeable at an early stage of the disease, especially in carcinoma as compared with sarcoma. Removal of the growths produces no appreciable change in this condition, from which it appears that the alteration in the serum favours the growth of malignant tumours rather than results from their presence.

W. D. H.

Antagonistic Action of Ammonium and Calcium Salts. Carl Voegtlin and I. King (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxviii; *J. Biol. Chem.*, 6).—In acidosis the blood and urine contain excess of ammonia. The intravenous injection of ammonium lactate, chloride, and β-hydroxybutyrate produces symptoms of acid intoxication, whilst that of calcium salts antagonises the toxic action.
W. D. H.

Physiological Action of Allylthiocarbimide. E. Wace Carlier (*Bio-Chem. J.*, 1909, 4, 107—116).—Allylthiocarbimide (like allyl sulphide) acts as a poison, paralysing respiratory and vaso-motor centres, producing muscular spasms, affecting the heart-beat, and lowering body-temperature. The thiocarbimide is the more powerful of the two substances.
W. D. H.

Ureidoglucose [Carbamidodextrose]. Paul Mayer (*Biochem. Zeitsch.*, 1909, 17, 145—155).—Schoorl has shown that a compound of urea and dextrose can be formed: $CHO\cdot[CH\cdot OH]_4\cdot CH_2\cdot OH + CO(NH_2)_2 = NH_2\cdot CO\cdot NH\colon CH\cdot[CH\cdot OH]_4\cdot CH_2\cdot OH + H_2O$, and the compound so formed (carbamidodextrose) can be resolved into its components by dilute mineral acids. Carbamidodextrose is lævorotatory; $[\alpha]_D - 23\cdot3°$. When given to rabbits by the mouth, about 7% is burnt in the body, and about 22% reappears unchanged in the urine, with a small quantity as carbamidoglycuronic acid. If given subcutaneously, 30 to 60%, and if given intravenously about 60%, reappears as such in the urine. Evidence was also obtained, although not absolutely conclusive, that the liver is in small degree able to resolve it into its constituents.
W. D. H.

Oxidation of Carbon Monoxide. Joseph H. Kastle (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxiii—xxiv; *J. Biol. Chem.*, 6).—Iodosobenzoic acid may be employed to oxidise carbon monoxide, but whether this oxidation can be accomplished when the gas is combined with hæmoglobin, for the relief of carbon monoxide poisoning, is not yet settled.
W. D. H.

Experimental Lead Poisoning. Kenneth Goadby (*J. Hygiene*, 1909, 9, 122—133).—Experiments on cats show that the inhalation of lead dust causes lead poisoning; the lead may therefore enter by the respiratory as well as by the gastro-intestinal tracts. That this also applies to men engaged in industrial processes was also shown by the fact that the laboratory workers suffered from the toxic effects until later during the work when precautions were taken to prevent inhalation of the dust.
W. D. H.

Mercurial Poisoning of Men in the Respiration Calorimeter. Metabolism during Fever. Thorne M. Carpenter and Francis Gano Benedict (*Amer. J. Physiol.*, 1909, 24, 187—202, 203—233).—During the course of numerous observations on men in the calorimeter, toxic symptoms were observed in some cases which are attributed to the effect of mercurial vapour originating from the mercury used in the valves of the apparatus. Among the symptoms so produced, fever was one, and an opportunity thus occurred of studying metabolism in the febrile state. The observations are fragmentary, seeing that they were not undertaken primarily for the study of fever. The data must be studied in the original papers. There is evidence that, at any rate during the height of the fever, there is increased heat production; conclusions regarding heat elimination are not so clear. W. D. H.

Protection to Acetonitrile Poisoning by Thyroid Feeding. S. P. Beebe (*Proc. Amer. Soc. Biol. Chem.*, 1908, xiii; *J. Biol. Chem.*, 6).—In mice the protective action of thyroid feeding against acetonitrile poisoning is not so uniform as in Hunt's experiments. In about 40% of the mice there was no protective action. W. D. H.

The Mechanism of Atoxyl Action. A. Breinl and Maximilian Nierenstein (*Zeitsch. Immunitätsforsch. exp. Therap.*, 1909, 1, 620—632; Reprint).—Atoxyl enters into combination with the proteins of serum. On treating this atoxyl combination under certain conditions with liver emulsion, oxidative ferments, or hydrogen peroxide, arsenic in an inorganic form is set free. Under these conditions, atoxyl will exert a tryponocidal action. The setting free of arsenic in this form can be accomplished *in vivo* either by organs of the body or by the trypanosomes themselves. At the same time a reduction process takes place, whereby arsenious acid and aniline are derived from atoxyl, and the aniline is excreted in the fæces. The chief action of the atoxyl is due to the setting free of arsenic in inorganic form. S. B. S.

Chemistry of Vegetable Physiology and Agriculture.

Efficiency of Berkefeld Filters. I. Andrew Wilson. II. William Bulloch and J. Andersen Craw (*J. Hygiene*, 1909, 9, 33—34, 35—45).—In reply to Bulloch and Craw's statements as to Berkefeld filters (Abstr., 1908, ii, 314), Wilson points out that the filters are injured by sterilisation in the autoclave at 120°, and should be sterilised by boiling water. The former authors publish more experiments which support their previous statements, although they sterilised the filters in the way recommended by Wilson.

W. D. H.

Anti-putrescent Effects of Copper Salts. Alfred Springer, sen., and Alfred Springer, jun. (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxii—xxxiii; *J. Biol. Chem.*, 6).—The non-putrescence of a certified milk excited suspicion of an added antiseptic; this was ultimately traced to copper from the boiler used for boiling cloths, pails, etc. Experiments showed that copper salts are selective in their action; they particularly inhibit the growth of putrefying bacteria, but the lactic acid organism among others is not much affected. W. D. H.

Differentiation of Lactose-fermenting Bacilli. Alfred MacConkey (*J. Hygiene*, 1909, 9, 86—103)—The tests at present used are not adequate to differentiate lactose-fermenting bacilli. Other tests are suggested, the use of which it is hoped will put the bacteriological examination of water on a firmer basis. W. D. H.

Food-poisoning Bacilli and Efficiency of Rat Viruses. Francis A. Bainbridge (*J. Path. Bacteriol.*, 1909, 13, 443—466).—The viruses examined owe their potency to bacilli indistinguishable from *B. Aertryck* and *B. Gaertner*, but their destructive power on rats is inconstant, the death rate varying from 20 to 50%. Phosphorus paste is more efficient (61—67 %). Probably some of the rats become immune. The entire innocence of the bacterial viruses for man is a statement which needs justifying. W. D. H.

Action of Bacteria and Yeasts in Rendering Soluble the Phosphoric Acid of Compounds Insoluble in Water. E. Kröber (*J. Landw.*, 1909, 57, 5—80).—The activity of bacteria and yeasts, by the production of acids, in liberating insoluble phosphoric acid may be of considerable importance. The chief agent is carbon dioxide; acetic, butyric, lactic, and other acids are also produced. The action on phosphates is hindered by the presence of calcium, magnesium, and ammonium carbonates, ferric and ferrous hydroxides, etc.

The action of the acids produced by bacteria varies considerably with different phosphates. Tricalcium and dicalcium phosphates and the tetracalcium phosphate of basic slag are dissolved much more rapidly, and in much greater quantities, than the sparingly soluble, crystalline, and amorphous crude phosphates.

The increased effect of the more sparingly soluble phosphates in humous soils, as compared with other soils, is attributed to the greater activity in such soils of acid-producing bacteria, fungi, and yeasts.

N. H. J. M.

Relation of Magnesium and Phosphorus to Growth of Fungi. Howard S. Reed (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxiii; *J. Biol. Chem.*, 6).—Certain relations between these two elements in nutrient solutions have striking effects on growth, and especially on spore formation in *Aspergillus niger*; the latter may be almost inhibited by reducing the phosphorus to small amounts. W. D. H.

Enzymes of Some Lower Fungi. Arthur W. Dox (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxiv—xxv; *J. Biol. Chem.*, 6).—From *Penicillium* cultures, an enzyme resembling erepsin was obtained; this is most active at the neutral point of methyl-orange; a hippuric acid splitting enzyme was also found. In other kinds of *Penicillium* the enzyme activity was very variable. W. D. H.

Are Fungi Able to Utilise the Elementary Nitrogen of the Air and to Increase the Total Nitrogen in the Soil? Berthold Heinze (*Bied. Zentr.*, 1909, 38, 280; from *Annal. mycologici*, 1906, 4, 41—63).—Bluish-green algæ assimilate free nitrogen, although not to the same extent as *Azotobacter*. It is doubtful whether mould fungi can fix nitrogen, but even if they can not, they are important as sources of carbon for nitrogen-fixing bacteria.

In the microbiological fixation of nitrogen, the first products are probably amino-acids, perhaps salts of carbamic acid. Higher amino-acids would next be formed, and from these, by mutual condensations, proteids would be produced. N. H. J. M.

The Prochromogen of the Respiration Chromogen of Plants. Wladimir I. Palladin (*Ber. Deut. bot. Ges.*, 1909, **27**, (3), 101—106).—The author adduces evidence to show that the chromogen of the leaf (Palladin, *ibid.*, 1908, **26**, 125) exists in combination, to which he gives the name prochromogen. From this the chromogen is liberated as required by an enzyme, and is therefore not found in any quantity in the leaf as a general rule. In spring, however, when the physiological processes are intense, free chromogen can be found in larger quantity, which can be still further increased by feeding the leaf with sucrose. E. J. R.

Theory of the Respiration of Plants. I and II. Wladimir I. Palladin (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 459—478, 519—546 *).—The author discusses exhaustively previous work on aerobic and anaerobic respiration (compare Abstr., 1906, ii, 481, 570, 696; 1907, ii, 385; 1908, ii, 416, etc.), from which the following conclusions are drawn.

The first reactions of respiration are reactions of anaerobic decomposition, brought about by enzymes. These reactions are similar to the reactions resulting from dry distillation, consisting of a series of successive reductions and oxidations by means of combined oxygen in the net-work of organic substances. Besides dextrose, other substances may afford material for anaerobic respiration, which may proceed without formation of alcohol but with formation of other compounds. Anaerobic respiration transforms stable constituents of the plants which do not undergo direct oxidation into extremely unstable, readily oxidisable substances. Alcohol is formed only during anaerobic respiration, and not during normal respiration in air, intermediate substances which are formed earlier than alcohol, and are hence more labile, themselves undergoing oxidation. Aerobic plants are capable of living in media free from oxygen without developing carbon dioxide. Respiratory oxydases are ordinary pigment-forming enzymes, and are incapable of direct oxidation of the products of anaerobic decomposition which are related to compounds of the aliphatic series. The respiratory chromogens are very widely distributed in plants; they are not oxidised directly by the oxygen of the air, the presence of special oxydases being required for the various chromogens. The respiratory pigments formed in plants usually undergo immediate reduction to colourless chromogens, these chromogens being related to aromatic compounds. Dextrose, as the initial product of the assimilation of carbon, is the parent substance from which aromatic compounds are formed in plants; as in dry distillation, so also in plant tissues, the benzene ring is formed from dextrose. To compounds, in the form of which the chromogens occur in a combined state in the tissues, the author gives the name pro-chromogens" (compare preceding abstract). Absence of chromogens renders impossible, not only oxidation processes in plants, but also oxidation of pyrogallol by the latter. T. H. P.

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* and *Biochem. Zeitsch.*, 1909, **18**, 151—206.

Disassimilation in Plants. N. T. Deleano (*Biochem. Zeitsch.*, 1909, 17, 225—230).—The mould *Lactarius sanguifluus* contains two kinds of lipase, one belonging to the mycelium, insoluble in the nutritive medium, soluble in glycerol and acting as serum lipase does, best at 42—50°. The other originates from the cells, passes into the nutritive medium, and acts like pancreatic lipase independently of temperature changes. At the time of fructification, lipase action is the dominating factor; after this stage is passed, lipase action can no longer be detected, the enzymes being either destroyed or their action inhibited. W. D. H.

New Methods of Colouring Vegetable Phosphorus Compounds. Corrado Bongiovanni (*Staz. sperim. agrar. ital.*, 1909, 42, 116—120).—For detecting organic phosphorus compounds in plant tissues, the author recommends the following methods, which he has applied to the seeds of *Ricinus communis*, wheat, and *Tropaeolum majus.*

(1) Sections of the seeds are warmed gently with dilute hydrochloric acid, washed several times with water, treated with 10% ferric chloride solution, again washed, immersed in 10% potassium thiocyanate, and, after further washing, examined under the microsope, when the globoids are seen to be stained yellow.

(2) The sections are immersed for about fifteen minutes in a saturated solution of molybdic acid in hydrochloric acid and then placed, without washing, in a 10% stannous chloride solution containing a few drops of 5% potassium or ammonium thiocyanate solution. In this way the cell-sap is coloured a faint yellow, and the globoids of the aleurone granules an intense reddish-violet, whilst the protoplasm either remains colourless or assumes a faint violet coloration. T. H. P.

Distribution of Rennet in the Parts and Tissues of Plants. C. Gerber (*Compt. rend.*, 1909, 148, 992—995).—The coagulating power of the parts of various plants has been determined with reference to milk at 42°. In the green parts of the plant the rennet is roughly proportional to the chlorophyll. The reproductive apparatus contains more rennet than the vegetative organs, the *style* being more active than the *achene.* Rennet appears to be distributed in the plant in the same manner as the proteolytic ferment, so that both activities may be due to one and the same enzyme.

In the root and stalk, the *liber* alone contains any appreciable rennet activity, but rennet is also present in the green bark. In plants like the mulberry, the green parts of which contain pectase, rennet can be better studied in the *liber* of the stalk than in the leaves. R. J. C.

Fatty Oil from the Fruits of Aesculus hippocastanum. MORTEN STILLESEN (*Chem. Zeit.*, 1909, 33, 497—498).—This oil was at one time used in medicine. The fruits yield on extraction with ether 1·5 to 3·0% of a yellowish-brown, rather viscid oil with a faint odour reminiscent of mustard oil, but on distilling 5 kilos. of the fruits in steam no volatile oil was obtained. The oil has D_{15}^{15} 0·9260, n_D^{20} 1·4747, saponification number 194·5, iodine number 95·4, Reichert-Meissl number 1·54, Hehner number 92·9, acetyl number 13·5, and unsaponifiable matter (phytosterol) 0·53%. By extracting the lead salts of the mixed fatty acids with ether and oxidising with permanganate the liquid acids thus separated, evidence was obtained that these consisted mainly of oleic acid with a little linoleic acid. The solid fatty acids, which were present only in small amount, appeared to consist of stearic and palmitic acids. All the acids are present in the oil as glyceryl esters.

T. A. H.

The Fruit of Aralia hispida. J. MILTON GILCHRIST (*Chem. News*, 1909, 99, 211).—The ripe fruit of this plant from Sylvan Beach, New York, was dried at 105—110°, when it was found to contain 41·72% of sugar, probably lævulose, also citric acid and tartaric acid as well as acetic acid. The results of analyses of the ash gave the following composition :

SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	P_2O_5.	SO_3.
13·59	9·13	9·13	1·25	1·72	25·66	13·63	15·01	5·28

The nitrogen content of the fruit was found to be 1·5%, and potassium iodide iodine solution gave no indication of the presence of any alkaloid. From the nutlets contained in the fruit, by grinding them to powder, and successively extracting with ether, oils were obtained amounting to about 45% of the dried nuts. The saponification value was found to be 517, which corresponds with palmitic acid, and the products of saponification seemed also to contain oleic acid.

J. V. E.

Are the Cinchona Alkaloids a Protection for the Plant? P. VAN LEERSUM (*Pharm. Weekblad*, 1909, 46, 369—376).—From the results of experiments, the author concludes that the cinchona alkaloids do not protect the plants against the attacks of insects.

A. J. W.

Càscola (Falling) of the Flowers of Frappato Vines. ENRICO PANTANELLI (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 406—411).—The author has investigated a case of càscola of the vine, and finds that healthy grapes and leaves contain considerably more carbohydrates of all sorts and considerably less of the various forms of nitrogen than the diseased grapes and leaves. The conclusion is drawn that the disease is due to excess of nitrogenous nutrition in a soil otherwise poor in nitrogen and in phosphoric acid.

T. H. P.

Indigo Products from Northern Nigeria. ARTHUR G. PERKIN (*J. Soc. Chem. Ind.*, 1909, 28, 353—355).—The author has published already the results of an investigation of the "Gara plant" (*Loncho-*

carpus cyanescens) of Sierra Leone (*ibid.*, 1907, 26, 389), the fermented leaves and stems of which were found to yield 0·65% of indigotin. In the present paper an account is given of the examination of a further sample of this plant and of indigo extracted from it.

A specimen of mixed stems and leaves from Northern Nigeria contained 0·65% of indigotin, whilst a sample of indigo also from this Colony contained 21·47 to 21·65% of indigotin, 1·1 to 1·3% of indirubin, and 12·15% of "brown matter" soluble in sodium hydroxide, the rest being moisture, inorganic matter, etc. The botanical origin of these two samples is uncertain, but comparison of fragments of leaves and stems present in each of them with corresponding parts of the "Gara plant" showed that they were probably, derived from this, and this is probably also the case with the samples of fermented leaves and indigo from Northern Nigeria examined by Rawson previously (*J. Soc. Chem. Ind.*, 1888, 17, 429). The presence of considerable quantities of "brown matter" appears to be characteristic of all these products. No samples of the plant containing the undecomposed glucoside from which the indigotin is presumably derived in the first instance have yet been obtained. T. A. H.

Formation of Indigotin in Plants. Oskar Walther (*Ber. Deut. bot. Ges.*, 1909, 27, 106—110).—The author considers that the enzyme, peroxydase, plays an important part in the formation of indigotin in plants. The hydrolysis of the glucoside indican to dextrose and indoxyl, and the subsequent oxidation of the latter to indigotin, are, he supposes, both brought about by enzymes. General oxidation processes in the plant are also discussed, with special reference to the respiration chromogen of Palladin (Abstr., 1908, ii, 416). E. J. R.

Amount of Hydrocyanic Acid in Reed-millet. Johann Behrens (*Bied. Zentr.*, 1909, 38, 282; from *Ber. Versuchs-Stat. Augustenberg*, 1906, 38).—Plants of *Sorghum saccharatum* when crushed in a mortar with water and distilled after two days yielded, 52 mg. of hydrogen cyanide per kilo. of fresh substance. N. H. J. M.

Action of Fertilising Salts on Plant Enzymes. Michael X. Sullivan (*Proc. Amer. Soc. Biol. Chem.*, 1908, xliv; *J. Biol. Chem.*, 6). —Potassium sulphate retards, whilst nitrate and mixtures of calcium hydrogen phosphate, sodium nitrate, and potassium sulphate accelerate, the oxidising action of wheat roots. The mixture of the three salts in equal quantities increases, the phosphate only increases, and the sulphate alone diminishes, the activity of malt diastase. Sodium nitrate has no action. Plants were grown in a mixture containing 100 parts per million of phosphoric acid, ammonia, and potassium oxide, and in a mixture of this with 200 milligrams of starch paste. The roots convert the starch into sugar. This activity was retarded by potassium sulphate and calcium hydrogen phosphate, but increased by sodium nitrate or by a mixture of the three salts. W. D. H.

Influence of Environment on the Composition of Wheat. Frank T. Shutt (*J. Soc. Chem. Ind.*, 1909, 28, 336—338).—Results are given showing the effect of soil moisture, especially during the period of maturation, on the quality of wheat grown under conditions of high temperatures. The amount of gluten largely depends on the character of the season, whilst the quality of the gluten is determined by the variety; the quality of the wheat is influenced by both factors. When the soil contains sufficient moisture to bring the wheat crop to maturity, a succeeding period of hot, dry weather is desirable.

N. H. J. M.

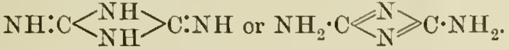
Manurial Experiments on Cereals with Calcium Nitrate. GIULIO PARIS (*Bied. Zentr.*, 1909, **38**, 230—231; from *Staz. sper. agrar.*, 1908, **41**, 171).—The employment of calcium nitrate, or sodium nitrate and lime, is recommended for non-calcareous, volcanic soils.

N. H. J. M.

Manuring Sugar Beet with Sodium Chloride. KARL ANDRLÍK and JOSEF URBAN (*Zeitsch. Zuckerind. Böhm*, 1909, **33**, 477—485).—The employment of sodium chloride cannot result in a marked decrease in the amount of sugar in sugar beet provided that the amount of sodium in the roots and in the whole plant is not increased. Further experiments are required to show whether such application can be beneficial.

N. H. J. M.

Nitrogenous Nutrition of Plants by means of Amino-compounds. RENATO PEROTTI (*Staz. sperim. agrar. ital.*, 1908, **41**, 593—608).—Working under sterile conditions with maize, beans, wheat, and rice, as both young and adult plants, the author finds that dicyanodiamide can be used directly as a nitrogenous food by these plants to an extent not less than other amino-compounds and ammonium nitrate are used, provided that the amount of dicyanodiamide employed does not reach the toxic dose; this compound offers the great advantage, that its toxic action is extremely slight. The biochemical behaviour of dicyanodiamide would indicate its structure to be either



$$\mathrm{NH{:}C}<\begin{matrix}\mathrm{NH}\\\mathrm{NH}\end{matrix}>\mathrm{C{:}NH} \text{ or } \mathrm{NH_2{\cdot}C}\ll\begin{matrix}\mathrm{N}\\\mathrm{N}\end{matrix}\gg\mathrm{C{\cdot}NH_2}.$$

This view of the constitution is supported by the physiological behaviour of dicyanodiamide compared with that of cyanamide, the latter containing a $\cdot$C⋮N group, which has a strong toxic action.

T. H. P.

Action of Ammoniacal Nitrogen [as Manure] Under the Influence of Lime. THEODOR PFEIFFER, ALBERT HEPNER, and L. FRANK (*Bied. Zentr.*, 1909, **38**, 226—228; from *Mitt. landw. Inst. Univ. Breslau*, 1908, **4**, 331).—On peaty soil ammonium salts only act favourably when lime is also applied. On sandy soil, injury due to the effect of ammonium salts is only to be feared when exceptionally large amounts of lime are applied, or when lime is applied too late. In the case of loamy soils, as much as 1% of calcium carbonate was without injurious effect.

N. H. J. M.

Analytical Chemistry.

Potassium Hydrogen Tartrate as Standard Substance. CONSTANTIN KOLLO (*Pharm. Zentr.-h.*, 1909, 50, 315—317).—The author proposes potassium hydrogen tartrate as a fit standard substance both in acidimetry and alkalimetry, on account of its being non-hygroscopic and readily obtainable in a pure condition.

As, however, its solubility in water is rather limited, a *N*/10-solution must be prepared by dissolving 18·819 grams in 600 c.c. of boiling water and diluting this when cold with water up to a litre. Free alkalis may then be titrated with phenolphthalein as indicator. If, however, mineral acids have to be standardised, 1·8819 grams are carefully ignited, and the resulting potassium carbonate is dissolved in water and titrated with the acid, using methyl-orange as indicator.

L. DE K.

Potassium Hydrogen Tartrate as Standard Substance. RUDOLF HEFELMANN (*Pharm. Zentr.-h.*, 1909, 50, 334—335).—The author observes that Kollo's use of potassium hydrogen tartrate (preceding abstract) is not novel, and that the use of this salt has been recommended from time to time by several analysts including himself.

L. DE K.

Potassium Chlorate Containing Bromate. ERNST PIESZCZEK (*Pharm. Zeit.*, 1909, 54, 325).—The author agrees with Klopstock (this vol., ii, 136) that commercial potassium chlorate (prepared electrolytically from carnallite lyes) frequently contains bromate. The amount may be estimated as follows: the sample is fused with an equal weight of ferric hydroxide until all effervescence ceases. The mass is then exhausted with water, and the filtrate evaporated to dryness. The residue is extracted repeatedly with strong alcohol, which dissolves the potassium bromide and leaves the bulk of the chloride undissolved. The alcoholic solution is evaporated to dryness, and the residue, dissolved in water and precipitated with silver nitrate, the silver bromide, and chloride, so obtained is washed, fused, and weighed. It is then heated in a current of chlorine, which expels the bromine, and re-weighed. From the difference in the weighings the bromine is calculated as usual. L. DE K.

Estimation of Total Sulphur in Urine. F. W. GILL and HARRY S. GRINDLEY (*Proc. Amer. Soc. biol. Chem.*, 1908, xi; *J. Biol. Chem.*, 6).—There is a loss of sulphur attending the estimation of this element in urines when the sodium peroxide method is used.

W. D. H.

Quantitative Estimation of Tellurium. ALEXANDER GUTBIER and FERDINAND FLURY (*Chem. News*, 1909, 99, 217. Compare Abstr., 1903, ii, 328).—The possibility of satisfactorily estimating tellurium by Frerichs' gravimetric method (Abstr., 1903, ii, 41) is called into question. The authors now publish a series of twelve results of most careful determinations of tellurium in extremely pure tellurium dioxide by Frerichs' method; these neither agree with the theoretical 79·95% Te nor amongst themselves, varying from 82·80 to 89·28% Te. On examining the precipitates obtained, they proved to be free from dioxide and from potassium, but, however, contained iodine, which could not be removed even by continued washing for some hours. The great affinity of iodine for tellurium (Abstr., 1902, ii, 653) being in this case very pronounced, renders it impossible to carry out quantitative estimations of tellurium by Frerichs' method, owing to formation of tellurium tetraiodide. J. V. E.

Estimation of Nitrogen by Kjeldahl's Method, especially in Milk. GEORG WIEGNER (*J. Landw.*, 1909, **57**, 81—110).—About 10 grams of milk, weighed in the flask, are heated with 25 c.c. of sulphuric acid and a drop of mercury for about ten minutes, when frothing ceases; 10 grams of potassium sulphate are then added, and the heating continued until the liquid is colourless. The solution, diluted with 50 c.c. of water, is filtered to remove unoxidised fat before being distilled. Potassium hydroxide solution (600 grams in 1 litre of water) is added in sufficient quantity nearly to neutralise the acid, the mixture allowed to cool, and then the rest of the potash solution (making 175 c.c.) and 100 c.c. of 17·5% solution of potassium sulphide added. The distillation is carried out in a new form of apparatus, of which a sketch is given, and, with the amount of solutions employed, is continued for forty-five minutes. The ammonia is collected in 60 c.c. of *N*/10-sulphuric acid, which is finally diluted to exactly 250 c.c. Fifteen c.c. of 10% potassium iodide solution and 15 c.c. of 4% potassium iodate solution are then added, the flask closed, and left for forty-five minutes. It is then titrated with *N*/10-thiosulphate solution.

Copper sulphate should not be employed instead of mercury for milk, as low results are obtained. Potassium hydroxide is preferable to sodium hydroxide, as the solutions boil without bumping, and addition of zinc is unnecessary. N. H. J. M.

Estimation of Nitrogen in Saltpetre by means of Stannous Chloride and Iron Filings. ALB. KLEIBER (*Chem. Zeit.*, 1909, **33**, 479—480).—Ten grams of the sample are dissolved in water up to 150 c.c., and 7·5 c.c. (0·5 gram) are placed in a 700—1000 c.c. distillation flask, and 5 grams of stannous chloride, 15 c.c. of strong hydrochloric acid, and 4—5 grams of iron filings are added. After warming for ten to fifteen minutes on the water-bath, 50—100 c.c. of water are added, also a small lump of paraffin, and then 60 c.c. of strong aqueous sodium hydroxide.

The ammonia formed is then distilled off and collected in a receiver containing 20 c.c. of *N*/2-sulphuric acid; the distillation should take about half an hour. L. DE K.

Estimation of Nitric Acid by Nitron in Liquids Containing Many Organic Substances. HARTWIG FRANZEN and E. LÖHMANN (*J. pr. Chem.*, 1909, [ii], **79**, 330—338).—The usual volumetric methods for the estimation of a mixture of nitrous and nitric acids are inapplicable to bacteriological cultures; good results are obtained with nitron. The authors use Busch's method, in which the total nitric acid is estimated after the nitrous acid has been oxidised to nitric acid by hydrogen peroxide, and the residual nitric acid is determined after decomposition of the nitrous acid by hydrazine sulphate.

The estimation in the presence of Bouillon's solution gives too low results, owing to the retention of some nitron nitrate in colloidal solution. If this is prevented by the addition of 2 to 2·5 c.c. of concentrated sulphuric acid per 200 c.c. of solution, the estimation in the presence of Bouillon's solution is as accurate as in water only. Since oxalic acid is a common constituent of bacteriological cultures, the presence of sulphuric acid has the additional advantage of preventing the precipitation of nitron oxalate. A somewhat large excess of nitron should be used. C. S.

Estimation of Phosphorus in Foods, Fæces, and Urine. F. W. Gill, J. B. Peterson, and Harry S. Grindley (*Proc. Amer. Soc. Biol. Chem.*, 1908, xii; *J. Biol. Chem.*, 6).—The (*a*) magnesium nitrate, (*b*) nitric acid, (*c*) aqua regia, (*d*) Kjeldahl, (*e*) hydrochloric acid and potassium chlorate, (*f*) nitric and hydrochloric acids, and (*g*) direct ashing methods were compared; methods *a*, *b*, *d*, *f*, and *g* gave practically identical results. The uranium acetate volumetric method applied to urine, compared with the nitro-hydrochloric acid method, shows that the former gives lower results.

W. D. H.

Estimation of Phosphoric Acid with Uranium Acetate. Robert B. Gibson and Clarence Estes (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxv—xxvi; *J. Biol. Chem.*, 6).—An excess of standard uranium acetate solution is added, and after decanting or filtering from the precipitated uranium phosphate, the uncombined uranium is estimated colorimetrically by addition of potassium ferrocyanide, and determination in the usual way of the depth of colour produced.

W. D. H.

Estimation of Phosphoric Acid in Ashes. W. Plücker (*Zeitsch. Nahr. Genussm.*, 1909, 17, 446—454).—The method of estimating phosphoric acid proposed by Lorenz (Abstr., 1901, ii, 278), in which the precipitate of ammonium phosphomolybdate is weighed directly, was found by the author to be trustworthy. The method is particularly useful for the estimation of very small quantities of phosphoric acid, as each mg. of the latter yields 30·35 mg. of precipitate. The presence of iron, aluminium, and silica is without influence on the results obtained. For the estimation of phosphoric acid in the ash of organic substances, it is recommended that the substance should be first treated with calcium acetate solution or with milk of lime in order to prevent loss of volatile phosphorus compounds during the ignition. W. P. S.

The Simultaneous Estimation of Carbon Monoxide, Hydrogen, and Methane by Fractional Combustion. V. Nesmjeloff (*Zeitsch. anal. Chem.*, 1909, 48, 232—272).—The author arrives at the following conclusions. The fractional combustion by means of silver oxide is not suitable for practical purposes. A simultaneous combustion of carbon moxoxide, hydrogen, and methane over palladium-asbestos allows of the estimation of the carbon monoxide alone if the velocity of the current does not exceed 1 litre per sixty minutes. The combustion of the mixture for the purpose of estimating the carbon monoxide, by passing it over copper oxide heated at 250°, gives good results, and the methane is not affected.

L. de K.

Gases Disengaged by the Action of Copper Salts on Steel. E. Goutal (*Compt. rend.*, 1909, 148, 988—991. Compare Carnot and Goutal, Abstr., 1897, ii, 520).—During the dissolution of cast-iron or steel in potassium cupric chloride, gaseous compounds of carbon are given off which appear to have been occluded in the metal. An error in the estimation of carbon in steel may arise if account is not taken of these gaseous products. To estimate them, the author dissolves 10 grams of steel filings or shavings in potassium cupric chloride at 45° in two hours. The solution is then boiled, and the gases are carried forward in a slow current of purified nitrogen and passed through baryta water to absorb carbon dioxide, sulphuric acid saturated with bromine to absorb unsaturated hydrocarbons, and finally through a tube, containing glass wool moistened with iodic acid, maintained at 75°. In the last, carbon monoxide is absorbed with liberation of iodine, which is carried forward into chloroform and afterwards titrated with standard thiosulphate. Carbon dioxide is estimated as barium carbonate and as barium sulphate.

The total volatile carbon is determined in a further sample of steel dissolved in the same way, the gaseous stream being mixed with oxygen and passed over a heated platinum spiral. The carbon dioxide produced is estimated in the usual way.

A typical hard steel contained 0·5960% solid carbon, 0·0185% carbon as carbon dioxide, 0·0059% as carbon monoxide, and 0·0171% as unknown hydrocarbons, etc.

R. J. C.

Estimation of Carbon and Phosphorus in Steel. Andrew A Blair (*J. Iron Steel Inst.*, 1909, i,*).—In the estimation of phosphorus, weighing the phosphomolybdate precipitate dried at 110° for two hours, and titrating its solution after reduction, give identical results, and the volumetric method is more rapid.

Experiments with potassium cupric chloride show that there is no production of hydrocarbons, and therefore no loss of carbon, when steel is dissolved in a solution of a copper salt. The carbon in steel is best estimated by direct combustion, carried out rapidly, so that the heat of oxidation causes complete oxidation, and fusion of the oxide formed. A platinum boat is used, with a layer of alumina under the steel. The experiments were made in a platinum combustion tube.

C. H. D.

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* from *Advance proof.*

Estimation of Carbon in Aliphatic Hydroxy-compounds by the Wet Process.

Ernst Berl and A. G. Innes (*Ber.*, 1909, 42, 1305—1309).—The necessity for a rapid and trustworthy method for estimating the amount of cellulose in a cuprammonium solution of this substance, coupled with the inapplicability of the ordinary combustion method, owing to the difficulty of filtering and purifying precipitated cellulose, led the authors to devise the following method.

A known weight of substance is introduced into a round-bottomed flask, which can be attached by means of a ground-glass junction to a Bunte burette. After evacuating the apparatus, 5—6 c.c. of a saturated solution of chromic acid are introduced into the flask from a tap funnel, which is fused into the side of the flask. After the reaction has subsided, 5 to 6 c.c. of syrupy phosphoric acid are introduced, and the reaction is completed by five to ten minutes' heating, The carbon dioxide is then driven over into the burette by running hot water into the flask from the tap funnel. After twenty minutes, the bottom of the burette is opened over a saturated salt solution, and the level of the liquid is read ; the carbon dioxide is then absorbed by potassium hydroxide, and, after displacing the latter by salt solution, the level is again read, from which the volume of carbon dioxide can be calculated.

As shown by various accordant test analyses, the method is applicable to aliphatic hydroxy-compounds which are not volatile in a vacuum or with steam, but not to aromatic compounds, owing to the tendency to form carbon monoxide and gaseous hydrocarbons. In cases in which chromic acid and phosphoric acid alone do not suffice for complete oxidation, a globule of mercury should be added.

Since chromic acid and phosphoric acids are both liable to contain organic impurities, a blank experiment should be made. The phosphoric acid is best prepared by dissolving pure white phosphoric oxide in a small quantity of water. The use of sulphuric acid in place of phosphoric acid is not to be recommended, owing to the formation of sulphur dioxide.

The amount of material used for analysis must be sufficiently small to ensure the entire oxidation taking place under reduced pressure.

P. H.

Precipitation of Fischer's Salt (Potassium Cobaltinitrite).

Lucien L. de Koninck (*Bull. Soc. chim. Belg.*, 1909, 23, 200—202).—For the detection of potassium by precipitation as cobaltinitrite, the author recommends the use of a solution prepared as follows : 50 grams of cobalt nitrate are dissolved in a litre of water with the addition of 25 c.c. of nitric acid (D 1·2), and this is mixed with a solution obtained by dissolving 300 grams of sodium nitrite in a litre. Before use, the orange-coloured solution is left for twenty-four to forty-eight hours to allow of the precipitation of any small quantity of potassium which may be present. With this solution, potassium can just be detected if present in a concentration of 1 in 10,000.

For the precipitation of cobalt, a solution prepared by dissolving 35 grams of sodium nitrite and 22 grams of potassium nitrate in

100 c.c. of water is recommended. This avoids the use of potassium nitrite, which is not easily obtainable in a pure condition.

H. M. D.

Compensation Apparatus for Rapid Methods of Electrolytic Analysis. Arthur Fischer (*Chem. Zeit.*, 1909, 33, 337).—A description of a convenient arrangement of apparatus for making measurements of the cathode potential during the deposition of metals in the way described by Sand (Trans., 1907, 91, 373).

The improvements introduced consist in using a voltmeter to measure the compensating *E.M.F.*, and a galvanometer as zero instrument in place of a capillary electrometer, the rheostat and measuring instruments being permanently connected in one box. T. E.

Constant Current Electro-analysis. Horace W. Gillett (*J. Physical Chem.*, 1909, 13, 336—340).—In the separation of copper from zinc, when the copper remaining in solution has become too dilute to carry all the current, electrolysis of the acid begins and continues whilst the last traces of copper are deposited. The liberation of hydrogen prevents the separation of zinc, which requires a higher potential. If two metals, *A* and *C*, to be separated lie on the same side of hydrogen in the potential scale, it is usual to employ a constant voltage method, but if an excess of another metal, *B*, requiring an intermediate voltage is added, it will serve to prevent the deposition of metal *C*, even although the voltage used is higher than its deposition potential. The metal *C* must not be passive under the conditions employed, but must be capable of redissolving should it be locally deposited owing to local rise in current density or imperfect stirring. Thus in phosphate solution at 60° the following decomposition potentials were given by Root (compare Abstr., 1903, ii, 683): Ag 1·3, Cu 1·6, Pb 2·2, H 2·25. The author shows that in separating silver from lead at 60°, excess of copper is a perfect preventative, the whole of the silver being readily deposited with some copper, but without a trace of lead, with a current of 1 ampere at 2·5 rising to 2·9 volts.

The number of possible applications of this method is small, because of the complications introduced by formation of alloys, amalgams, and solid solutions. R. J. C.

Microchemical Analyses. [V.] Analysis of the Iron Group. Nicolaas Schoorl (*Zeitsch. anal. Chem.*, 1909, 48, 209—231. Compare this vol., ii, 96).—Cobalt is best precipitated by means of a solution containing equal weights of ammonium thiocyanate and mercuric chloride. Nickel is best precipitated by means of an ammoniacal solution of dimethylglyoxime, or by means of lead acetate and potassium nitrite. Iron is detected by the ferrocyanide reaction. Aluminium is best precipitated as alum by means of potassium hydrogen sulphate; this is preferable to cæsium sulphate, formerly employed. Chromium, which should be present as chromate, is best precipitated with benzidine hydrochloride in presence of sodium acetate. Zinc is best precipitated by adding sodium hydrogen carbonate to its solution in aqueous sodium hydroxide. Manganese is best precipitated by means of potassium hydrogen oxalate.

In all above-mentioned reactions, characteristic, microscopic appearances are observed.

In case of some, or all, of the metals being present, the usual course of separation must be adopted. For instance, nickel and cobalt are separated from the others by treating the mixed sulphides with dilute hydrochloric acid, and the cobalt is then separated from the nickel with potassium nitrite. Advantage is taken of the fact that iron and chromium oxides become very insoluble in acids on ignition, thus enabling the alumina to be extracted by dilute nitric acid, etc.

L. DE K.

Estimation of Tungsten. M. TSCHILIKIN (*Ber.*, 1909, 42, 1302—1304).—Tungstic acid is quantitatively precipitated by α-naphthylamine hydrochloride in the cold; for this purpose, 25 c.c. of a 2% solution of sodium tungstate are slowly added from a burette to 100 c.c. of a solution of 25 grams of α-naphthylamine with 1½ molecular proportions of hydrochloric acid in 1 litre of water; after three hours, the precipitate is filtered and washed with the naphthylamine solution, diluted with five parts of water, and ignited while moist in a platinum crucible. The composition of the precipitate is expressed by the formula: $(C_{10}H_9N)_2(WO_3)_5,3H_2O$, the formula of the corresponding precipitate formed with benzidine (compare von Knorre, Abstr., 1905, ii, 286) being $(C_{12}H_{12}N_2)_2(WO_3)_5,5H_2O$. Commercial sodium tungstate has the composition $Na_2WO_4,2H_2O$.

P. H.

Estimation of Thorium in Monazite Sand. VINCENZO BORELLI (*Gazzetta*, 1909, 39, i, 425—448).—The author deals with the disgregation of the sand, the solution of the products of disgregation, precipitation of the oxalates of the rare earths, transformation of the oxalates into nitrates, and the separation of the thorium from the other elements. For the details of the various steps in the estimation, the original must be consulted.

T. H. P.

Precipitation of Antimony from Thioantimonate Solutions. WILLY SCHULTE (*Metallurgie*, 1909, 6, 214—220).—Aluminium or magnesium precipitates metallic antimony from solutions of alkali thioantimonates, or from a suspension of freshly precipitated antimony pentasulphide. The process is not quantitative, as the antimony at first precipitated is partly re-dissolved by the sodium sulphide formed if allowed to remain long in contact with the solution (compare Czerwek, Abstr., 1906, ii, 708).

Magnesium is more active, and the method may be used quantitatively. Precipitated antimony sulphide, free from other sulphides, is dissolved in sodium sulphide solution and evaporated on the water-bath, and, when cool, magnesium powder is added. The solution becomes warm, and hydrogen sulphide is evolved. The process is continued until further additions of magnesium produce no further evolution of gas. After stirring and remaining overnight, the solution is stirred until no more gas is evolved. Dilute sulphuric acid is then added to remove magnesium hydroxide and excess of magnesium, and the whole is filtered through a tared filter. The precipitated antimony is washed successively with warm water, dilute sulphuric acid, boiling water, and alcohol, dried at 110°, and weighed. The presence of sodium hydroxide in the solution must be avoided, as it prevents the action of the magnesium.

Small quantities of antimony hydride are formed when magnesium acts on a hot solution of thioantimonate.

When an alloy of 90% tin and 10% antimony (Britannia metal) is made the anode in a solution of sodium sulphide at 80—90°, the alloy may be deposited unchanged in composition on an iron cathode, copper and iron remaining in the anode mud. With an electrolyte consisting of sodium thioantimonate and sodium hydroxide at 65—70°, the tin may be dissolved, the antimony being deposited on the cathode in a practically pure state (99·66%). C. H. D.

Separation of Antimony and Tin. Georg Panajotow (*Ber.*, 1909, 42, 1296—1299).—Antimony sulphide is insoluble in a 15% solution of hydrochloric acid, whereas tin sulphide is soluble; this fact was made use of for the separation of antimony and tin by heating a mixture of the two salts, containing about 15% of hydrochloric acid, at 50—60°, and passing a rapid stream of hydrogen sulphide through the mixture for half an hour; the liquid was then cooled to 30°, and treated for ten minutes more with a slower stream of gas. The precipitate was filtered on a Gooch crucible, washed with water containing hydrogen sulphide to remove any tin, and weighed after treatment successively with alcohol, carbon disulphide, and ether. The tin contained in the filtrate was precipitated by hydrogen sulphide after neutralisation with ammonia. The method gives accurate results.

P. H.

Rhodium. Alexander Gutbier and M. Riess (*Ber.*, 1909, 42, 1437—1441).—The reduction of rhodium salts to the metallic state by hydrazine (Gutbier and Hofmeier, Abstr., 1905, ii, 533) may be utilised for the estimation of rhodium (compare Jannasch and Mayer; Abstr., 1905, ii, 557). Experiments made with chloropentamminerhodium chloride and the bromo-bromide, and with several alkali rhodipentahalides (Gutbier and Hüttlinger, Abstr., 1908, ii, 200), show that the precipitation should take place in hot alkaline solution, and that the concentration should not be too great. The rhodium hydrosol at first formed soon changes into a metallic, glistening precipitate, evolution of gas taking place owing to the catalytic action of the metal on hydrazine. The precipitate is dried at 105°, and heated first in air, then in hydrogen, and finally in carbon dioxide freed from oxygen. The metal does not retain alkali. C. H. D.

Naphthalene Picrate and the Estimation of Naphthalene. Willem P. Jorissen and J. Rutten (*Chem. Weekblad.*, 1909, 6, 261—272).—A summary of the methods employed in the estimation of naphthalene. That of Stavorinus (*Het. Gas*, 1905, 477) is condemned on account of the decomposition of naphthalene picrate and the volatility of both naphthalene and picric acid at 100°. That of Colman and Smith (Abstr., 1900, ii, 372) gives too low results, owing to solution of the naphthalene picrate in the washing water employed.

A. J. W.

Nylander's Reaction. M. E. Rehfuss and Philip B. Hawk (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxi—xxxii; *J. Biol. Chem.*, 6).—Mercuric chloride and chloroform do not interfere with Nylander's test for sugar in urine (as stated by Bechhold) provided the urine is first boiled for five minutes. The reaction is regarded as a valuable confirmatory test, and details are given regarding the best way to effect it and the influence of other substances on it. Protein does not interfere with it, unless more than 2% is present. W. D. H.

Barfoed's Test. William H. Welker (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxxiii—xxxiv; *J. Biol. Chem.*, 6).—In some cases where the test was used a greenish-white precipitate was produced; the cause was traced to the presence of sodium chloride, quite a small percentage of which interferes with the reaction. The nature of the precipitate is not yet clear. W. D. H.

Correction of Acidity and a New Method for the Estimation of Free Volatile Acidity in Wines. Nicolò Gallo (*Staz. sper. agrar. Ital.*, 1909, 42, 37—50).—Experiments with wines to which acetic acid had been added show that when it is a question of diminishing the amount of this acid in a wine by 0·5—0·6$^{0}/_{00}$, recourse should be had to normal potassium tartrate and never to the carbonate. Calcium carbonate should only be used when the proportion of acetic acid to be neutralised is very large.

The following method for estimating the free volatile acidity of wines depends on the observation made by the author that there exists a practically constant ratio between the quantity of acetic acid in a wine and the quantity extracted by ether in a single extraction. The method consists in shaking 25 c.c. of the wine and 30 c.c. of ether vigorously for a few seconds in a 100 c.c. cylinder with a ground stopper. When the ether has settled, 20 c.c. of it are removed by a pipette and shaken with water in a small beaker. The ether is then evaporated at a low temperature, and the remaining acid solution titrated with *N*/10-sodium hydroxide and phenolphthalein. The number of c.c. of alkali solution, multiplied by 0·24 and by 3·30, gives the parts of free acetic acid per 1000 of the wine. T. H. P.

Estimation of Oxalic Acid in Urine. Hugh MacLean (*Zeitsch. physiol. Chem.*, 1909, 60, 20—24).—Autenrieth and Barth's method (Abstr., 1902, ii, 575) consists briefly in treating the dog's urine with excess of calcium chloride and ammonia until strongly alkaline; the mixture is filtered after eighteen to twenty hours, and the precipitate dissolved in 15% hydrochloric acid; this is shaken with a mixture of ether and alcohol, which dissolves the oxalic acid, and in the final aqueous solution acidified with acetic acid, the estimation of oxalic acid as calcium oxalate is made in the usual way. At Salkowski's suggestion, the accuracy of this method was tested, and the statement

of Autenrieth and Barth is confirmed that the method is exact; no oxalic acid is left in the filtrate after removal of the first precipitate.
W. D. H.

Estimation of Total Tartaric Acid in Tartaric Products. P. Carles (*J. Pharm. Chim.*, 1909, [vi], 29, 381—382; *Bull. Soc. chim.*, 1909, [iv], 5, 567—568; *Ann. Chim. anal.*, 14, 183—185).—In addition to the precautions already mentioned (Abstr., 1907, ii, 655) as necessary in making this estimation, it is suggested that litmus paper should be used as an indicator. An aqueous solution of potassium tartrate or potassium sodium tartrate, whichever product will result from the titration, is prepared, and the coloration assumed by pieces of litmus paper placed in this is used as a standard of neutrality. The potassium hydrogen tartrate to be titrated is then dissolved in water, a few drops of phenolphthalein added and some pieces of litmus paper, and the titration proceeded with until the litmus paper assumes a blue tint. The liquid is then boiled, more litmus paper added, and the titration continued until the colour of the paper is the same as that in the standard liquid. At this stage the addition of a few more drops of alkali should cause the red coloration due to phenolphthalein to appear.
T. A. H.

Estimation of Amino-acids in Urine. Valdemar Henriques (*Zeitsch. physiol. Chem.*, 1909, 60, 1—9).—See this vol., ii, 506.

Halphen's Reaction. Léon Ronnet (*J. Pharm. Chim.*, 1909, [vi], 29, 379—380).—The author has tried the modified form of this reaction described by Garnier (this vol., ii, 447), and finds that it is less sensitive than the test as originally described by Halphen. For the quantitative estimation of cotton seed oil, the author applies Halphen's reaction colorimetrically, the colour given by an oil containing a known quantity of cotton seed oil being used as a standard of comparison.
T. A. H.

Estimation of Added Water in Altered Milks. André Kling and Paul Roy (*Compt. rend.*, 1909, 148, 1050—1052 *).—The estimation of added water in milk which has been kept for any length of time is complicated by the fermentations which occur in spite of preservatives and convert part of the non-fatty solids into volatile matter. The authors determine the total nitrogen by Kjeldahl's method, having first evaporated to dryness under reduced pressure. The total nitrogen per litre multiplied by the factor 6·39 gives the amount of protein matter, which is either compared with that in a milk of similar origin, or, in default, with the standard value 33 grams per litre. The authors show that this method is capable of yielding concordant results with the same milks when fresh and after two years' storage. The addition of 5% of water can be detected unmistakably.
R. J. C.

Distinctions between Natural, Artificial, and Synthetic Camphors. Wilhelm Lohmann (*Ber. Deut. pharm. Ges.*, 1909, 19, 222—226).—After a historical résumé of the processes available for the manufacture of synthetic camphor, the author points out that the melting point is not a safe means of distinguishing natural from synthetic camphor, and that the best means is the observation of the rotatory power, all the synthetic camphor so far placed on the market being optically inactive. Some commercial synthetic camphors are impure, and consist of mixtures of camphene, borneol or *iso*borneol, and camphor. The presence of such impurities can be detected by fractional sublimation, and estimated by acetylating the crude product, suitably diluted with turpentine oil, and determining the amount of acetic esters formed. The estimation might also be carried out by melting the crude product with phthalic anhydride, converting the bornyl hydrogen phthalate formed into the sodium salt by adding sodium hydroxide, and then shaking out the unchanged camphor with ether and weighing it. Artificial camphor (pinene hydrochloride) can be readily distinguished from natural camphor by heating it with potassium hydroxide until all volatile products have passed off, and then testing the residue for chlorides. T. A. H.

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* and *Ann. Chim. anal.*, 1909, 14, 215—217.

Choline in Animal Tissues and Fluids. W. Webster (*Bio-Chem. J.*, 1909, 4, 117—126).—The author is of the opinion that the tests hitherto employed for the detection of choline in the blood are untrustworthy, and denies that choline can be detected by their means. W. D. H.

Estimation of Creatinine. F. C. Cook (*Proc. Amer. Soc. Biol. Chem.*, 1908, xxiv; *J. Biol. Chem.*, 6).—Certain factors influence the estimation of creatinine by Folin's colorimetric method. If more than 10 c.c. of alkali are used, lower results are obtained, because the alkali dissolves creatinine picrate. Thirty c.c. of picric acid gave but slightly higher results than 15 c.c. The presence of protein and the period of standing are also factors that influence the results. Of four other methods examined, the autoclave method of Benedict and Myers gave the most satisfactory results. W. D. H.

Alkaloid Reactions. Eserine (Physostigmine). C. Reichard (*Pharm. Zentr.-h.*, 1909, 50, 375—384).—The author is investigating systematically the colour reactions and other distinctive characters of the chief alkaloids, and a considerable number of these have been dealt with in previous papers.

If a little eserine sulphate is placed on a glass slip and moistened with water, and to the drop of solution so formed a drop of sulphuric acid is added, characteristic crystals of a sparingly soluble sulphate separate. After a while, the preparation gradually becomes oily and eventually resinous, but the crystals retain their characteristic appearance for a considerable time. With nitric acid, a similar separation of crystals occurs, and if the preparation is not warmed, the acid remains colourless for a day. On addition of potassium chromate to eserine sulphate in presence of nitric acid, a green mass is formed, and a similar change occurs, but more slowly, in presence of sulphuric acid. The alkaloid reduces molybdic acid very slowly and slightly in the cold, but rapidly gives a blue coloration on

warming. No coloration is given by eserine sulphate in the cold with titanic acid in sulphuric acid, but on warming slightly a yellowish-brown tint, changing to reddish-brown, is obtained; this rapidly disappears, yielding a colourless solution. The foregoing are the most characteristic of the numerous reactions described. In each case detailed directions for the application of the colour reaction are given.
T. A. H.

Reaction of Hordenine and Urotropine. A. Labat (*J. Pharm. Chim.*, 1909, [vi], 29, 433—435).—Denigès has shown (Abstr., 1908, i, 775) that hordenine, like other substances containing a *p*-tolyl nucleus, gives a green coloration when heated with formaldehyde and sulphuric acid. The author now points out that since urotropine yields formaldehyde under the conditions of this experiment, it can replace the latter in making the test, and conversely, that hordenine can be used for the detection of urotropine. T. A. H.

Estimation of Urea. Clarence Quinan (*J. Biol. Chem.*, 1909, 6, 173—179).—A modification of the hypobromite method is described, in which greater exactness is obtained by the use of a modified Lunge's gas-volumeter. W. D. H.

Detection in Urine of Chromogens of Methylene-blue, Thionin, and Lauth's Violet by Oxidising Agents in Acid Media. C. Fleig (*J. Pharm. Chim.*, 1909, [vi], 29, 513—520).—Methylene-blue may be eliminated in the urine as such or as (1) a "chromogen of elimination," which is stable and yields methylene-blue only after boiling with acetic acid and subsequent oxidation by exposure to air, or (2) a "chromogen of fermentation," formed by the action of micro-organisms in alkaline or feebly acid urines. This second chromogen is unstable and yields methylene-blue by mere exposure to the atmosphere.

The new test consists in adding either hydrogen peroxide or ammonium persulphate to urine supposed to contain either of these chromogens; the unstable one yields methylene-blue at once, the stable one only after the further addition of acetic acid and boiling for a few minutes. If methylene-blue is present to begin with, it is extracted by means of chloroform. Methylene-blue is eliminated in the fæces in the form of a chromogen different from those occurring in the urine. The same test may be applied to the detection of the chromogens of thionin and Lauth's violet in urine, but in the case of thionin, dilute hydrochloric acid is preferable to acetic acid as a hydrolysing agent, and, further, ferric chloride solution may be used as an oxidising agent in place of hydrogen peroxide or ammonium persulphate. The test is not applicable to the urinary chromogens of triphenylmethane dyes. Fluorescein is eliminated in the urine unchanged. T. A H.

Formation of Crystals of Hæmin by means of Alkali Iodides or Bromides. Georges Guérin (*J. Pharm. Chim.*, 1909, [vi], 29, 377—378).—Fresh defibrinated blood was dialysed until it no longer contained chlorides. A drop of this preparation, placed on a microscope slide and evaporated to dryness, gave on addition of a dilute solution of an alkali bromide or iodide, microscopic crystals identical in form with those of hæmin (hæmatin hydrochloride) produced in Teichmann's test for blood. T. A. H.

Tests for Pus and Blood. JOSEPH H. KASTLE and NORMAN ROBERTS (*Proc. Amer. Soc. Biol. Chem.*, 1908, xlvi—xlvii; *J. Biol. Chem.*, 6).—Peroxydases are absent from normal urine, but are present in active inflammatory conditions of the genito-urinary tract when pus appears in the urine.

Phenolphthalein as a reagent for the detection of blood is very sensitive; 1 part of blood in 80 million parts of water can be detected. Blood-stains more than a year old give the reaction.

W. D. H.

Animal Fæces. I. Comparison of the Analysis of Fresh and Air-dried Fæces. A. D. EMMETT and HARRY S. GRINDLEY (*J. Amer. Chem. Soc.*, 1909, 31, 569—579).—In the preparation of fæces for analysis, it is usual to dry them in the air, and afterwards reduce them to powder. It is desirable, however, to determine the composition of the fresh, undried material, since a loss of nitrogen usually occurs on drying. Moreover, the analysis of fresh dung facilitates the study of the nature of the metabolic and undigested products.

It has now been found that proteins, fat, moisture, ash, carbohydrates, and phosphorus can be easily and satisfactorily estimated in the fresh fæces of swine and cattle. In the case of swine-dung, it is considered that the losses which occur on drying are chiefly due to mechanical errors introduced by the manipulation of the material during the drying process, and not to the loss of any particular constituent. In cases in which there is any danger of loss of nitrogen or the products of fermentation, the analysis of the fresh material, preserved with thymol, is preferable to the dry method. In connexion with the analysis of fresh fæces, it is necessary that the food-stuffs supplied to the animals should be ground or chopped fairly small, otherwise the dung will contain coarse, undigested particles, and it will consequently be difficult to obtain an average sample. E. G.

New Reaction of Abrastol. OTTORINO CARLETTI (*Boll. Chim. Farm.*, 1909, 6, 223—224).—The following reaction allows of the detection of 0·00005 gram of abrastol in the extract prepared from food materials in the manner described by Vitali (Abstr., 1908, ii, 642). After removal of the solvent by evaporation, the residue is treated with 2—3 c.c. of concentrated sulphuric acid and then with 1 to 2 drops of a 10% aqueous or alcoholic tartaric acid solution, the capsule being then cautiously heated by means of a small flame. In presence of abrastol, emerald-green striæ form in the liquid, which becomes uniformly green on shaking. The coloration disappears if the solution is diluted with water. This reaction has the advantage over that given by ferric chloride, that it is not influenced by the presence of organic acids. T. H. P.

General and Physical Chemistry.

Measurement of the Optical Constants of Certain Liquid Crystals. Ernst Dorn and Wilhelm Lohmann (*Ann. Physik*, 1909, [iv], 29, 533—565).—The refractive indices of the isotropic and the two anisotropic forms of ethyl ethoxybenzylideneamino-α-methylcinnamate and ethyl ethoxybenzylideneamino-α-ethylcinnamate have been determined. Values are recorded for the lithium, sodium, and the green and blue mercury lines.

The double refraction of the anisotropic modifications is very considerable, being about twice as large as that of calcspar. With increase of temperature, the refractive index of the isotropic liquids diminishes, whilst that of the crystalline liquids increases. In the anisotropic modifications which are formed at lower temperatures both substances behave like uniaxial solid crystals. This is regarded as evidence against the emulsion theory of crystalline liquids.

H. M. D.

Biaxial Liquid Crystals. Frédéric Wallerant (*Compt. rend.*, 1909, 148, 1291—1292).—The anisotropic liquid obtained by melting azoxyanisole possesses different optical properties when examined in a beam of convergent light from the anisotropic liquid which results when isotropic liquid anisole is cooled down. This is strong evidence in favour of the idea that such anisotropic liquids really contain liquid crystals, the orientation of the crystals depending on how the anisotropic liquid has been obtained. T. S. P.

Magnetic Dichroism of Different Minerals. Georges Meslin (*Compt. rend.*, 1909, 148, 1179—1180).—From an examination of thirty different minerals immersed in nine different liquids, it is shown that the magnetic dichroism of the mineral runs parallel with the amount of double refraction; for example, with siderite, where the difference between the indices of refraction is 0·31, the magnetic dichroism is strong, whereas with apatite, where the difference is only 0·004, there is no magnetic dichroism. Moreover, when there is a change in sign in the dichroism, it occurs when the mineral is immersed in a liquid of which the refractive index is approximately equal to the mean refractive index of the mineral. T. S. P.

Secondary Spectrum of Hydrogen. A. Dufour (*Phil. Mag.*, 1909, [vi], 17, 854—855).—A claim for priority against Hogley (this vol., ii, 359). The stellar and secondary spectra were always obtained together in the author's experiments, even when the hydrogen was at atmospheric pressure. H. M. D.

Arc Spectrum of Yttrium. G. Eberhard (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 245—253).—The wave-lengths and intensities of the lines in the arc spectrum of yttrium have been measured. By the use of a series of rare earth fractions, obtained by Urbain's method of fractionation, the gradual variation in the intensity of the yttrium lines was also observed. The results are tabulated and compared with previous measurements of Kayser and of Exner and Haschek. The differences in the recorded intensities of many lines are attributed to the different times of exposure of the plates.

H. M. D.

Quantitative Spark Spectra of Titanium, Uranium, and Vanadium. JAMES H. POLLOK (*Sci. Proc. Roy. Dubl. Soc.*, 1909, 11, 331—337).—Photographs have been obtained of the spark spectra yielded by solutions containing 10, 1, 0·1, 0·01, and 0·001% of titanium, uranium, and vanadium. The wave-lengths, intensities, and persistencies of the various lines are recorded in tabular form. From a comparison of the spectra given by the fused metals, it was found that in all three cases the solutions give all the lines exhibited by the free metals.

H. M. D.

An Example of a Longitudinal Positive Zeeman Effect in the Emission Spectra of Vapours. A. DUFOUR (*Compt. rend.*, 1909, **148**, 1311—1312).—An investigation of the action of a magnetic field of 28,000 units on the band $\lambda = 5789·7$ of oxide of iron has shown that the Zeeman effect parallel to the lines of force is positive. The deviation of the magnetic doublet is about five times less than that for the sodium *D*-line, and the circular polarisation of the components is complete. Observations perpendicular to the lines of force indicate that the band in question furnishes an ordinary triplet.

No general relation exists between the occurrence of a longitudinal positive Zeeman effect and the incomplete extinction of the components of the magnetic doublets by a circular analyser. This rule only applies to certain classes of compounds; the observed facts again show that different band spectra possess different characteristics, and that the Zeeman effect may be utilised to classify them.

T. S. P.

Emission of Light in Banded Spectra. JOHANNES STARK (*Ann. Physik*, 1909, [iv], **29**, 316—330).—In reference to the view of Lenard and Saeland (this vol., ii, 283) that the phenomenon of phosphorescence is genetically connected with the photo-electric effect, the author points out that this is in agreement with his general theory of banded spectra (compare Abstr., 1907. ii, 147, 417; 1908, ii, 138, 746, 911; 1909, ii, 106, 109). According to this theory both phosphorescence and fluorescence are dependent on the absorption of light of short wave-lengths, resulting in the separation of valency electrons; the emission of light is then due to the re-union of the valency electrons with the atomic residues. Whereas in a fluorescing substance the valency electrons recombine immediately or after a very short interval with the atomic residues, it is supposed that the special characteristic of phosphorescence is caused by a combination of part of the separated electrons with other atoms, energy being required for the resolution of these combinations before re-combination of the electrons with the atomic residues can take place.

The author maintains the correctness of his previous view, that the line spectrum of an element is due to positively charged atoms of the element, and throws doubt on Lenard's theory, that the chief series of lines is due to electrically neutral atoms, and the secondary series to positively charged ions. H. M. D.

Influence of their State in Solution on the Absorption Spectra of Dissolved Dyes. SAMUEL E. SHEPPARD (*Proc. Roy. Soc.*, 1909, **82**, *A*, 256—270).—The absorption spectra of solutions of certain dyes have been examined. The absorption spectrum of the *iso*cyanines, pinacyanols, and cyanine in aqueous solution is quite different from that of the solutions in ethyl alcohol and other organic solvents. This difference is supposed to be due to the dye being present partly or wholly as a colloid in the aqueous solution. The fact that the aqueous solutions are coagulated by electrolysis and by repeated heating and cooling, and that they show the Tyndall effect, affords evidence in support of this view.

Dyes which are present in true solution show the smallest changes in the absorption spectrum when the concentration is varied. The absorption maxima are not displaced, and if the dyes are chemically stable, Beer's law is found to hold good. On the other hand, dyes which are wholly or partly present in the form of colloids exhibit considerable changes when the concentration alters and Beer's law does not hold. In solid media, like collodion and gelatin, similar relationships are found.

From his observations the author draws the conclusion that the process of dyeing is strictly analogous to the "solution" of dyes in liquid solvents, in that corresponding phases or grades of solution are to be found in the two cases. H. M. D.

Absorption Spectra of Solid Tetramethylpicene and of its Solutions. JOHN E. PURVIS and ANNIE HOMER (*Proc. Camb. Phil. Soc.*, 1909, **15**, 82—84. Compare Trans., 1908, **93**, 1319).—A comparison of the absorption spectra of the solid hydrocarbon and of its *N*/1000 solutions in benzene and ethyl alcohol has been made. In all cases three absorption bands are found, but the relative position of these varies. In the benzene solution both the general and selective absorption are shifted towards the red in comparison with the alcoholic solution, and there is a further shift in the case of the solid hydrocarbon. The phenomena are attributed to the differences in the damping effect exerted by the medium on the vibrations of the active molecules of the solute. H. M. D.

Absorption Spectra of Concentrated and Diluted Solutions of Chlorophyll. JOHN E. PURVIS (*Proc. Camb. Phil. Soc.*, 1909, **15**, 85—88).—A comparison of the absorption spectra of chlorophyll in concentrated and dilute solutions has been made. Ethyl-alcoholic solutions, the concentrations of which were in the ratio 719·8 : 1, were compared, photographic records of the absorption being taken after the solutions had been allowed to remain for gradually increasing intervals of time. The two freshly prepared solutions show bands at λ 538 and 565, and the general absorption in both begins at about λ 510. After standing for several days, the strong solution shows well-marked bands at λ 538 and 508, together with a trace of the band at λ 565, and the general absorption is very much smaller than in the freshly prepared solution. In the dilute solution λ 565 is stronger, and λ 538 much weaker, than in the corresponding strong solution, and no band can be observed at λ 508. The observed gradual changes in the spectra are supposed to be due to enzyme action. H. M. D.

Polarisation by Lateral Diffusion. GEORGES MESLIN (*Compt. rend.*, 1909, **148**, 1095—1097).—A limpid liquid illuminated by a ray of light and viewed from the side diffuses light, which is partly polarised in the plane defined by the incident and diffused beams. If crystalline particles are suspended in the liquid, the amount of diffused light is greater, but the proportion polarised is less, although in the same plane. This effect was found in more than 1000 different liquids. Boric acid suspended in liquids of refractive index greater than 1·42, such as terebenthene, benzene, aniline, etc., and also pyrogallol under certain conditions, exhibits the abnormal property of diffusing light which is polarised in a plane perpendicular to the plane of diffusion (negative dichroism). In this case the transmitted ray is polarised in the plane of diffusion (positive dichroism). In all other cases where the transmitted beam exhibits positive dichroism (such as potassium carbonate suspended in light petroleum), the diffused (reflected) beam is polarised in the same plane.

The peculiar spontaneous dichroism of boric acid suspensions is attributable to the orientation of the crystals by gravity. R. J. C.

An Ammonium Model. EDGAR WEDEKIND (*Ber.*, 1909, **42**, 2142—2147).—The model is composed of two concentric circular hoops, one of which can rotate about a vertical diameter inside the other one; by attaching five spheres to the circumferences of the two circles, or by placing one in the centre and four on the circumference, it is possible to explain the isomerism and mechanism of the formation of quaternary ammonium salts. For a detailed account of this the original paper should be consulted. P. H.

Calculations in Photochemical Processes. FRITZ WEIGERT (*Ber.*, 1909, **42**, 1783—1786).—Polemical. Reply to Byk (compare this vol., ii, 454). P. H.

Influence of Radium on Rate of Crystallisation. LOUIS FRISCHAUER (*Compt. rend.*, 1909, **148**, 1251—1254 [*]).—Sulphur, carefully purified by successive fractional distillations, was sublimed on to a microscope slide, where it appeared in detached hemispherical drops. Drops with a diameter less than 30μ do not crystallise spontaneously, whilst those of diameter more than 180μ crystallise in a few minutes. Most of the drops were from 54 to 90μ in diameter, about 65 being

[*] and *Le Radium*, 1909, **6**, 161—164.

deposited per square millimetre. These crystallised spontaneously at the rate of about one per day.

A slide was partly covered with lead sheet 5 mm. thick, and the remainder was exposed to the radiation from 25 mg. of radium contained in a glass bulb 0·9 mm. thick. The exposed part crystallised spontaneously, and by contact from drop to drop at such a rate that at the end of four days about 3 to 5 times as much was crystallised as on the protected part of the slide. The remaining drops in the exposed part all crystallised when the slide was heated at 70° for six hours, whereas only a moderate crystallisation occurred in the unexposed portion.

Solidification of superfused sulphur deposited inside a tube occurs spontaneously where radium emanation is allowed to settle down, but most of the rest of the sulphur remains liquid.

Röntgen rays are without effect on the rate of crystallisation, hence it is probable that radium γ-rays are also without effect. Since α-rays could not penetrate the glass of the bulb containing the radium, it follows that the crystallising action described was due to the radium β-rays. R. J. C.

Radium and Uranium in Radioactive Minerals. Ellen Gleditsch (*Compt. rend.*, 1909, 148, 1451—1453 *).—It is generally accepted from the experiments of Boltwood, McCoy, Rutherford, and Boltwood and Strutt (compare Abstr., 1905, ii, 295, 366, 568, 787) that the ratio of radium to uranium in all rocks is constant. The method of estimation by dissolving the mineral in acid and measuring the activity of the emanation given off is objected to by the author on various grounds, principally the fact that if the mineral contains sulphides, these, during the dissolution in nitric acid, give rise to barium and lead sulphates, which would carry down some radium sulphate.

The author estimates the radium in various minerals by dissolving them completely in suitable solvents. Alternate additions of barium chloride and sulphuric acid are made until the mother-liquors are no longer radioactive. The active precipitates are converted into carbonates by boiling with sodium hydroxide and sodium carbonate, and are then completely dissolved in hydrochloric acid. The radium in the solution is estimated by the emanation evolved. The ratio of radium to uranium is not constant in the minerals analysed. Joachimsthal pitchblende contains radium and uranium in the ratio given by Boltwood. A French autunite contains relatively less radium, and Ceylon thorianite more radium, than pitchblende. It might be supposed that since autunite is a secondary mineral, the original ratio may have become modified, as certain pyromorphites containing radium are free from uranium altogether. The discrepancy in the case of thorianite is more difficult to understand. R. J. C.

Absorption of the γ-Rays of Radium by Lead. Y. Tuomikoski (*Physikal. Zeitsch.*, 1909, 10, 372—374).—The absorption of the γ-rays from radium emanation by lead has been measured for different thicknesses reaching up to 19 cm. The value of the absorption coefficient decreases gradually as the thickness of the layer of lead traversed increases. Between 1·5 and 12 cm., it is, however, nearly constant, the value of λ being 0·52—0·50. The mean value of λ between 12·0 and 15·8 cm. is 0·39, and a further drop in the absorption coefficient then appears to take place, the mean value between 15·8 and 18 cm. being 0·25. H. M. D.

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* and *Le Radium*, 1909, 6, 165—166.

Radium Emanation. André Debierne (*Compt. rend.*, 1909, **148**, 1264—1267. Compare Rutherford, Abstr., 1908, ii, 791; Rutherford and Royds, this vol., ii, 203).—The emanation from a solution of 0·2 gram of radium was purified from oxygen, hydrogen, and carbon oxides by successive treatment with heated copper, copper oxide, phosphoric oxide, and fused potash. Nitrogen was removed by slightly heated metallic lithium. The purified emanation was liquefied between −175° and −150°, and a residue consisting of helium with a little emanation was pumped off. The liquefied emanation was free from helium and neon.

The mean volume of emanation in equilibrium with 1 gram of radium was found to be 0·58 cub. mm., a value in exact agreement with that given by Rutherford (*loc. cit.*), although the method of isolation was quite different. The actual volumes of emanation determined were 0·60, 0·52, 0·61, 0·59 after three, six, nine, and thirty-two days accumulation in the radium solution respectively. The initial contraction of the emanation and the final development of helium noted by Rutherford were observed. The emanation had a half-period of 3·81 days (Rutherford found 3·75), but the small proportion of uncondensed emanation mixed with the helium appeared to have a somewhat longer half-period. The emanation at atmospheric pressure exhibits spontaneous electric discharges, particularly if the containing tubes are of fusible lead glass, which, moreover, turns violet under the influence of the radiation. The phenomenon is attributed to the accumulation of electric charges from α- and β-particles when the glass has sufficient insulating power. R. J. C.

Liberation of Heat from Radioactive Substances. William Duane (*Compt. rend.*, 1909, **148**, 1448—1451).—An extremely sensitive calorimeter is described, consisting of two bulbs connected by a horizontal capillary tube and half filled with ether. The slightest temperature difference gives rise to a difference in vapour pressures, causing the ether to flow from the warmer to the cooler bulb until the difference in level in the two bulbs compensates the difference in vapour pressure. The bulbs are not completely evacuated, so that it is possible to get a small air bubble in the capillary tube to act as an index, which is either observed through a telescope or projected on to an enlarged scale. The whole calorimeter is supported on wax inside a block of lead, insulated by cotton wool from the containing zinc box, which is in turn placed in a thermostat. The apparatus, which is suitable for many physical, chemical, and biological measurements, is so sensitive that it is possible to detect with certainty in a few minutes a development of heat at the rate of 0·001 gram calorie per hour.

The radioactive substance or other source of heat to be examined is placed in a tube, which is fused inside one of the bulbs, so that it hangs in the ether. The total displacement of liquid or the rate of displacement may be measured. The author makes use of the Peltier effect to measure the actual amount of heat produced. A thermocouple of nickel and iron is placed in the tube along with the radioactive substance, and the exact current is passed to absorb at the thermojunction all the heat given out by the radioactive substance, so that no motion of the liquid in the capillary tube is apparent. The thermojunction is previously calibrated in the same apparatus against a second electric circuit developing a known amount of heat.

A salt containing 0·80 mg. of radium chloride developed heat at the rate of 0·073 cal. per hour, so that 1 gram of radium should evolve 120 cal. per hour (previous investigators have given 110, 117, and 118 cal.). Radiothorium was found to emit heat, an actual development of 0·025 cal. per hour being measured. A radium salt of equal radioactivity would give 0·039 cal., so that radiothorium disengages a quantity of heat which is of the same order as that given by radium.

Polonium, free from radium and radiothorium, was found to emit heat. R. J. C.

Secondary Rontgen Radiation from Air and Ethyl Bromide. J. Arnold Crowther (*Proc. Camb. Phil. Soc.*, 1909, **15**, 101—105. Compare Abstr., 1907, ii, 922).—The relative amounts of ionisation produced in ethyl bromide vapour by the secondary Röntgen rays which are emitted by ethyl bromide and air have been measured. From this result, and the extent to which the two kinds of secondary rays are absorbed by ethyl bromide, it is found that the intensity of the secondary radiation from ethyl bromide is 105 times that from air.

By means of observations on the absorption of the two kinds of secondary rays by filter paper, the previous measurements of the ratio (*loc. cit.*) have been corrected, and the intensity ratio obtained in this way is 101. The two values obtained from measurements made respectively in air and in ethyl bromide are thus in good agreement.

H. M. D.

Absorption Spectra of Mesitylene and Trichloromesitylene. John E. Purvis (*Proc. Camb. Phil. Soc.*, 1909, **15**, 89—90).—The author has compared the absorption spectra of mesitylene and trichloromesitylene in 0·001 molar ethyl-alcoholic solution. By the introduction of the three chlorine atoms the strong absorption band is shifted towards the red from λ 269—λ 254 to λ 287—λ 263. The persistence of the latter is very much greater than that of the mesitylene band. H. M. D.

Condition of Electric Charges on Particles Suspended in Gases; Charge on Chemical Fumes. Maurice de Broglie and Brizard (*Compt. rend.*, 1909, **148**, 1457—1458).—Smoke is examined by the ultramicroscope whilst subjected to an electric field. Ammonium chloride fume is found to consist of particles of one sign travelling with a relatively high velocity. If the fume is first exposed to radium, the mobility of the particles when in the electric field is four to five times less, and both + and − charges are observed. It is therefore supposed that a single particle can hold more than one charge. After exposure to radium, the particles soon return to their normal state of mobility and charge.

Generally speaking, fumes which are produced by chemical action unaccompanied by rise in temperature have no electric charge. Such are the fumes produced by moist air with stannic chloride, silicon fluoride, hydrogen chloride, nitric acid, Nordhausen sulphuric acid, phosphorus pentachloride, arsenic chloride, etc. Sulphur dust distilled in nitrogen also belongs to this category. These substances give particles which are neutral, but transformable, by ionising rays into large ions of both signs.

Products of violent chemical action are already charged and of both signs. Such are the fumes produced by throwing sodium, sulphuric oxide, phosphoric oxide, and phosphorus pentachloride into water. Products formed with flame, such as by projecting powdered arsenic or antimony into chlorine, the spontaneous combustion of hydrogen phosphide, etc., are also charged, but the ionisation in this case is allied to the well-known ionisation by flames. The phosphorescence of phosphorus gives rise to ionisation, but that of sulphur does not.

R. J. C.

Dielectric Constants of Mixtures of Solids. Ernst Rudolfi (*Zeitsch. physikal. Chem.*, 1909, 66, 705—732).—The melting-point curves and dielectric constants of a number of binary mixtures consisting mainly of naphthalene, anthracene, and their derivatives have been determined. The dielectric constants were measured by a modification of Drude's method, and only varied between 2·6 and 3·2. The equilibrium data are as follows: Naphthalene–bromocamphor, eutectic point 40·5° and 64% by weight of bromocamphor; naphthalene–phenanthrene, eutectic point 47·5° and 54% by weight of the latter component; naphthalene–*a*-naphthylamine, eutectic point 27·5° and 74% by weight of the latter component; naphthalene–*p*-toluidine, eutectic point 29° and 73% by weight of the latter component; naphthalene–anthracene, eutectic point 77° and 12% anthracene; mixed crystals may be formed between 0 and 12% anthracene; *β*-naphthol–anthracene, from 0—12% of anthracene mixed crystals separate, from 12—100% of anthracene this substance separates primarily from the fused mass; *β*-naphthylamine–anthracene behaves exactly like the last system; naphthalene–*β*-naphthol form a continuous series of mixed crystals, as do naphthalene and *β*-naphthylamine. In the latter case, however, the melting point of each of the pure components is lowered by the addition of the other. Finally, the system naphthalene–picric acid shows two eutectic points at 78·5° and 8% and 114° and 94% of picric acid respectively, and a compound containing the components in molecular proportions, which has been described by previous observers.

The dielectric constant of binary mixtures can be calculated from those of the pure components by means of a formula based on the expression $(\sqrt{K}-1)/d$, where d is the density, and it is shown that this formula applies whether the components exist separately or as mixed crystals. It also applies to the compound of picric acid and naphthalene, but no general conclusion can be drawn from a single example of this type. G. S.

Physico-chemical Interpretation of the Differences of Potential Existing in Living Tissues. PIERRE GIRARD (*Compt. rend.*, 1909, **148**, 1186—1189).—In a previous paper (this vol., ii, 463) the author has shown that when a membrane is placed in a concentration cell which is slightly acid or alkaline the polarisation of the membrane is, among other things, inversely proportional to the coefficient of viscosity of water. The alteration of *E.M.F.* of the cell with temperature will consequently not be proportional to the absolute temperature, as demanded by Nernst's equation, but will vary more rapidly in accordance with the variation with temperature of the viscosity of water. If the *E.M.F.* of polarisation is of opposite sign to that of the concentration cell, rise in temperature will lower the voltage of the cell more rapidly than corresponds with proportionality to the absolute temperature, whereas when the *E.M.F.*'s are of the same sign, the effect of a rise in temperature is to increase the voltage more rapidly than corresponds with proportionality to the absolute temperature. These conclusions have been verified by experiments on different concentration cells. Since the cell contents of living tissues deviate more or less from neutrality, an explanation is thus afforded of the results obtained by Lesser and others in experiments on the skin of a frog. T. S. P.

Modified Oxy-Hydrogen Gas Coulometer. J. W. TURRENTINE (*J. Physical Chem.*, 1909, **13**, 349—354).—A modified form of the Walter-Neumann coulometer is described, in which the electrodes are readily detachable. The new form of apparatus is much less liable to breakage than the old. H. M. D.

Conductivity of Non-luminous Sodium Vapour and the Relationship between the Ionisation of Gases and the Absorption of their Line Spectra. CHRISTIAN FÜCHTBAUER (*Physikal. Zeitsch.*, 1909, **10**, 374—377).—An experiment is described which indicates that sodium vapour begins to conduct electricity at about 200°. It has also been found that sodium vapour exposed to an arc light shows the characteristic absorption lines when the temperature reaches 190°. These observations support the view that sodium ions are the source of the lines in the absorption and emission spectrum. The other alkali metals also absorb the lines of the primary spectrum at low temperatures, and it is therefore probable that the electro-positive metals generally have a tendency to ionise in the form of vapour.
H. M. D.

Conduction of Electricity in Mixtures of Metals and their Salts. A. H. W. ATEN (*Zeitsch. physikal. Chem.*, 1909, **66**, 641—671).—The electrical conductivity of mixtures of bismuth chloride and bismuth in different proportions has been determined at different temperatures up to 350°. The measurements were made in an atmosphere of carbon dioxide, and, in order to obtain a sufficiently high resistance, the fused salt was contained in a capillary tube.

At low temperatures (250—280°) addition of bismuth lowers the conductivity of bismuth chloride, but at higher temperatures the conductivity first increases and then diminishes with progressive increase of bismuth, so that the curves obtained by plotting the composition as abscissæ against the conductivity as ordinates show very distinct maxima at the higher temperatures. The observations cannot be carried much beyond 40 mol. % of bismuth, owing to the limited solubility of the latter in the chloride, even at the higher temperatures. The temperature-coefficient of the conductivity of bismuth chloride is greater at high than at low temperatures, but that for mixtures containing a fair proportion of bismuth does not vary much with the temperature.

As regards mixtures rich in bismuth, it was only possible to examine those containing 98·9—100 mol. % of the metal, owing to the slight solubility of the chloride in the fused metal. Further, satisfactory measurements could only be made above 320°, owing probably to crystallisation of salt in the capillary at lower temperatures. Addition of bismuth trichloride causes a steady diminution in the conductivity of bismuth at all temperatures. The solubility of the trichloride in fused bismuth is smaller than the values given by Eggink (Abstr., 1908, ii, 1043).

The viscosity of bismuth trichloride and of mixtures of the salt and bismuth in varying proportions has been determined at a series of temperatures between 260° and 320° by a modified form of the Ostwald apparatus. The densities of the mixtures have also been determined within the same limits of temperature, which admits of the calculation of the viscosity in absolute measure. For a mixture of given composition the viscosity, η, diminishes and the limiting conductivity, λ, increases with temperature, but $\lambda\eta$ is not constant, nor does there appear to be any simple relationship between λ and η.

The theoretical bearing of the results is discussed, but considerable uncertainty is introduced owing to the fact that the proportion of the compound BiCl in the various mixtures is not known. G. S.

Electrical Conductivity and Dissociation of Sulphuric Acid in Aqueous Solutions at High Temperatures. YOGORO KATO (*Mem. Col. Sci. Eng. Kyōto*, 1908, i, 332—351).—The measurements were made in Noyes's laboratory by means of the platinum-lined bomb already described (Noyes and Coolidge, Abstr., 1904, ii, 226). Observations have been made at 18°, 100°, 156°, and 218°, and the equivalent conductivity, in reciprocal ohms, of solutions containing 0·5—12·5 milli-equivalents of the acid per litre are given in tabular form.

The ionisation of sulphuric acid takes place mainly according to the equation $H_2SO_4 \rightleftharpoons H^{\cdot} + HSO_4{}'$(1), but the latter ion undergoes partial ionisation in dilute solution as follows: $HSO_4{}' \rightleftharpoons H^{\cdot} + SO_4{}''$(2). It is shown that the ionisation relations can be calculated from the conductivity data when the $H^{\cdot}$ ion concentration and the concentration of the unionised acid are known, but the latter cannot be determined directly. On the assumption that the limiting conductivity for the $H^{\cdot}-HSO_4'$ dissociation is equal to that for acetic acid, the degree of dissociation, according to equation (1), is calculated, and is shown to correspond fairly closely with that for hydrochloric acid, especially at higher temperatures. On the assumption that this agreement holds throughout, the concentration of the unionised part of the acid, and hence the complete equilibrium relations at different temperatures and concentrations, have been calculated. The results are tested by applying van't Hoff's equation connecting displacement of equilibrium with temperature with the heat of reaction, the results being moderately satisfactory. G. S.

Conductivity of Solutions of Lithium Nitrate in Ternary Mixtures of Acetone, Methyl Alcohol, Ethyl Alcohol, and Water. Viscosity and Fluidity of the Mixtures. HARRY C. JONES and EDWARD G. MAHIN (*Amer. Chem. J.*, 1909, 41, 433—442). —The electrical conductivity of ternary mixtures (containing the components in varying proportions) of water, acetone, methyl and ethyl alcohols in dilutions of 10 to 1600 litres has been determined at 0° and 25°, and the results, as well as the temperature-coefficients of the conductivity, are given in tabular form. The viscosity and fluidity of the mixtures at 0° and 25° are also given. The results are very briefly discussed. G. S.

Relation between Electrical Conductivity and Thermoelectric Power of Alloys of Silver with Zinc. NICOLAI A. PUSHIN and M. S. MAXIMENKO (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 500—524).—The authors' measurements of the specific resistances, the temperature-coefficients of the latter, and the thermo-electric forces of alloys of silver and zinc, in conjunction with the results of Pushin (Abstr., 1907, ii, 618) and Petrenko (Abstr., 1906, ii, 284), lead to the following conclusions.

Silver dissolves in zinc to a small extent, forming solid solutions, and silver dissolves zinc, forming solid solutions containing not less than 30 atom % of zinc.

The results also indicate the presence of the following compounds of the two metals: (1) Zn_6Ag, analogous to Hg_6K, Hg_6Cs, Hg_6Rb, Cd_6Na, and Zn_6Cu (compare Kurnakoff and Kusnetzoff, Abstr., 1907, ii, 171; Kurnakoff and Schukowsky, Abstr., 1907, ii, 345); (2) Zn_4Ag (compare Maey, Abstr., 1905, ii, 146); (3) Zn_3Ag_2, which exhibits the maximum specific resistance, the maximum temperature-coefficient of the latter, and the maximum absolute thermo-electric voltage; (4) $ZnAg$; (5) $ZnAg_2$(?), Zn_2Ag(?), and $Zn_{10}Ag$(?), which may be compounds or solid solutions of definite concentrations.

Experimental confirmation is obtained of the view of Kurnakoff (*loc. cit.*) and Guertler (Abstr., 1907, ii, 65), that the formation of a solid solution is accompanied by considerable increase of the resistance of the alloy, which increases also with the concentration of the solid solution.

Comparison of the resistance and thermo-electric force curves demonstrates for silver-zinc alloys the truth of the view expressed by Thomson and by Liebenoff (Der elektrische Widerstand der Metalle), that the first current passing through an alloy usually produces in the latter a thermo-current which acts as a supplementary resistance. T. H. P.

Validity of Faraday's Law at Low Temperatures. Wendell G. Wilcox (*J. Physical Chem.*, 1909, **13**, 383—387).—The electro-deposition of silver from pyridine solutions of silver nitrate has been investigated at temperatures between 0° and −55°. As the temperature falls, the amount of silver deposited by a given quantity of electricity gradually diminishes; this is attributed to decomposition of the pyridine. It is shown that the difference between the amount of deposited silver and that required by Faraday's law increases with increase in the change of concentration at the electrodes. In spite of the observed discrepancies, the conclusion is drawn that Faraday's law regulates the electro-deposition at the temperatures of the experiments. H. M. D.

Chemical Changes Produced by Different Kinds of Rays. II. Action of the Direct Electric Current. Carl Neuberg (*Biochem. Zeitsch.*, 1909, **17**, 270—292. Compare Abstr., 1908, ii, 915).—Electrolysis of a number of substances was carried out between platinum electrodes in pure aqueous solution in closed vessels shielded from the light. In general, oxidative and hydrolytic changes were brought about. The multivalent alcohols give corresponding hydroxy-aldehydes or hydroxy-ketones. The carbohydrate acids with unbranched carbon chains give aldoses containing one atom of carbon less. Monosaccharides form osones and carboxylic acids; di- and tri-saccharides are hydrolysed, and undergo further changes like the monosaccharides. Glucosides and paired glycuronic acid derivatives are hydrolysed.

Amino-acids lose ammonia, and are converted into aldehydes with an atom of carbon less. Hydroxy- and diamino-acids behave similarly; Aminodicarboxylic acids form aldehydic acids. Peptones and proteins are hydrolysed, and in part converted into aldehydes; phosphatides and nucleic acids are decomposed, and the decomposition products further changed. In general, the electric current, like the enzymes, tends to form carbonyl compounds of great potential activity from indifferent substances; its action is analogous to the catalytic action of light. E. F. A.

Calculation of Ionic Hydration from Transport Numbers and Ionic Velocities. Ernst H. Riesenfeld and B. Reinhold (*Zeitsch. physikal. Chem.*, 1909, **66**, 672—686).—On the basis of Nernst's theory as to the movement of water with the ions in transport measurements, the authors derive the formula: $n_c = w_c - cx$ (1), where n_c is the experimental transport number (referred to the anion), w_c is the true transport number, c is the concentration, and x is a measure of the hydration of the anion. A number of curves are given in which the observed transport number is plotted against the concentration, and the following conclusions are drawn: (1) if in great dilution the anion wanders more rapidly than the cation; the latter is in general more highly hydrated than the former; (2) in such a case the transport number increases at first with increasing concentration; in the contrary case it diminishes.

The hydration cannot be calculated from equation (1) alone, but this can be done by combining the latter equation with another obtained by applying Stokes' law regarding the motion of a sphere in a medium of considerable resistance to the data for ionic velocities, and also from the ionic velocity data alone. The following values are thus obtained for the hydration of a number of ions at infinite dilution from the data for the ionic velocities, and very similar values are obtained from the alteration of the transport numbers with the temperature. The numbers denote the number of mols. of water per mol. of ion, and are presumably valid for 18°. $H^{\cdot}=0$, $K^{\cdot}=22$, $Na=71$, $Li=158$, $Ag^{\cdot}=37$, $\frac{1}{2}Cd^{\cdot\cdot}=55$, $\frac{1}{2}Cu^{\cdot\cdot}=56$, $OH'=11$, $Br'=20$, $I'=20$, $Cl'=21$, $NO_3'=25$, $ClO_3'=35$. G. S.

Theory of Electrolytic Ions. II. Electrolytic Dissociation of Water. RICHARD LORENZ and A. BÖHI (*Zeitsch. physikal. Chem.*, 1909, 66, 733—751. Compare Lorenz and Mohn, Abstr., 1907, ii, 838).—The *E.M.F.*'s of a number of cells of the type

$$H_2(Pt) \mid HCl \mid 0{\cdot}1KCl \mid KOH \mid H_2(Pt)$$

have been carefully measured at temperatures between 0° and 90°, and from the results the degree of dissociation of water calculated by Ostwald's method. The acid and alkali were used in *N*, *N*/10, and *N*/100 solution, but the most trustworthy results were obtained for *N*/10 solutions, and only these were used at higher temperatures. The contact differences of potential were corrected for by Planck's formula. The necessary data for calculating the degree of dissociation were found in the literature, except as regards the conductivity of *N*/10 potassium hydroxide at high temperatures, which was determined directly.

The values obtained for the degree of dissociation of water at different temperatures are as follows:

Temperature	0°	18°	25°	40°	60°	80°	90°
Degree of dissociation ...	0·37	0·85	1·10	1·98	3·55	5·92	$7{\cdot}30 \times 10^{-}$

The results are in good agreement with those obtained by other methods, and the values for the heat of dissociation calculated by substituting the above values in van't Hoff's formula connecting displacement of equilibrium with temperature agree well with recent measurements of the heat of neutralisation of strong acids and bases. G. S.

Magnetic Character of Compounds Prepared from Non-magnetic Elements. EDGAR WEDEKIND (*Zeitsch. physikal. Chem.*, 1909, 66, 614—632. Compare Abstr., 1907, ii, 353; Binet du Jassonneix, Abstr., 1906, ii, 520).—The magnetic properties of the following alloys of manganese, a boride, MnB, two antimonides, MnSb and Mn_2Sb, and a phosphide, MnP, have been investigated. Some experiments were made with the powdered materials, but the most trustworthy results were obtained with rods about 3 cm. long, which were obtained with considerable difficulty by fusing the materials in tubes of quartz or zirconium oxide in absence of air. The measurements of magnetic induction, etc., were made by a modification of the ordinary method in which a ballistic galvanometer is used.

The induction, magnetic permeability, and magnetic intensity for different strengths of field are given in tabular form, with similar observations on cobalt and wrought iron for comparison. They are also represented graphically, the magnetic induction being plotted against the field strength. The results are confirmed by a magnetometric method.

Of the compounds in question, the antimonide, MnSb, shows the greatest temporary magnetism and the phosphide the least. The compound (or end member of a series of mixed crystals) MnSb is five times more magnetic than the phosphide, and is only two and a-half times less magnetic than incompletely fused cobalt. A satisfactory comparison with iron is not practicable.

The weakly magnetic compounds retain their magnetism very strongly, being more effective than cast iron in this respect; the retaining power of the boride for magnetism is four times greater than that of the antimonide. The permanent magnetism is, however, in all cases less than that of steel.

The polarity of the boride is diminished by heating, and becomes zero at 450° G. S.

Coefficients of Expansion of Gases. ANATOLE LEDUC (*Compt. rend.*, 1909, **148**, 1173—1176).—From an exact knowledge of the molecular volumes of different gases (Abstr., 1909, ii, 381) and by means of formulæ which the author has previously developed, the mean and true coefficients of expansion at constant pressure and the mean and true coefficients of increase in pressure at constant volume have been calculated for twenty different gases. The mean coefficients hold for a range in temperature from 0° to 100°, and the true coefficients for 0°. The errors in the numbers obtained probably do not exceed one in a thousand. In all cases, including that of hydrogen, the coefficient of increase in pressure at constant volume is greater than that usually given for a perfect gas: 3663×10^{-6}.

T. S. P.

Specific Heat of Hydrogen Chloride from Explosion Experiments. MATHIAS PIER (*Zeitsch. physikal. Chem.*, 1909, **66**, 759—762. Compare Abstr., 1908, ii, 352).—It is shown that from the results of the explosion experiments described in the earlier paper the specific heat of hydrogen chloride at constant volume can be calculated. The results are in fair agreement with those calculated by means of the general formula for diatomic gases: $C_v = 4 \cdot 6000 + 0 \cdot 0005t$.

G. S.

Specific Heat of Ferromagnetic Substances: Alloys of Iron and Nickel. ANTOINE DUMAS (*Arch. Sci. phys. nat.*, 1909, **27**, 352—382, 453—478).—The author has made measurements of the specific heats of various alloys of nickel and iron, more especially in the region comprising the point of magnetic transformation (compare Weiss and Beck, Abstr., 1908, ii, 659).

The curves expressing the mean specific heat as a function of the temperature all follow similar courses. The specific heat increases at first slowly, then more and more rapidly up to a certain point at which the curve becomes horizontal; this point corresponds exactly with the point of magnetic transformation. Curves connecting the true specific heat with the temperature show that this specific heat at first exhibits increasingly rapid, parabolic augmentation, then a sudden fall to a lower value, and subsequently renewed rapid rise. The absolute value of the discontinuity of the true specific heat at the point where ferromagnetism disappears is proportional to the square of the absolute temperature of this transformation point.

The positions of the points of transformation do not obey the law of mixtures, but vary with the content of nickel in an ill-defined manner. Apparently, the other ferromagnetic properties obey a law similar to that determining the positions of the points of transformation.

T. H. P.

Thermo-endosmosis. Aubert (*Compt. rend.*, 1909, **148**, 1254—1255. Compare Lippmann, Abstr., 1907, ii, 668).—Two films of the same liquid, each 0·4 mm. thick, separated by a membrane, were maintained at different temperatures, and the direction of flow through the membrane was observed by means of capillary tube gauges. The membranes employed were gelatin, pigs' bladder, parchment, potato skin, and carrot skin. The rate of flow is proportional to the area of the membrane and to the temperature difference, and does not alter with time. The flow was always from the cooler to the warmer side of the membrane, whether the liquid used was pure water or a solution of acid, base, or salt. If the flow was obstructed, a pressure was developed which in some cases could exceed one atmosphere. R. J. C.

Dissociation of a Compound in a State of Equilibrium. Rudolf Ruer (*Zeitsch. physikal. Chem.*, 1909, **66**, 633—636).—The author points out that van Laar's criticism (this vol., ii, 376) of his results (Abstr., 1908, ii, 819) is based on a misunderstanding. G. S.

The Sintering-point Curve: a Simple Means of Detecting Chemical Compounds between Two Components. Alfred Stock (*Ber.*, 1909, **42**, 2059—2061).—The position of the maximum in a freezing-point curve corresponding with a binary compound is not always easy to fix, and Tammann's method of thermal analysis is not applicable to fused viscous substances of low conductivity. The sintering point is the temperature at which the eutectic begins to melt, and is readily observed. The sintering-point curve of a series of binary mixtures coincides approximately with the solidus, the sintering temperatures lying, however, slightly above the true eutectic temperatures. The curve shows a sharp cusp directed upwards at the composition corresponding with a compound. C. H. D.

Methods of Preventing Superheating. A. Kroner (*Zeitsch. physikal. Chem.*, 1909, 66, 637—640).—The superheating in a Beckmann's apparatus may be to a great extent overcome by the use of small, bell-shaped bodies, which are placed mouth downwards on the heated surface, or may be suspended in the boiling liquid. A still better effect is obtained when necessary by using a porous sheet of glass-wool or asbestos pressed against the heated surface. G. S.

A Source of Error but little Considered in the Determination of Boiling Points Under Diminished Pressure. C. von Rechenberg (*J. pr. Chem.*, 1909, [ii], 79, 475—491).—In the ordinary apparatus used for distillation under diminished pressure the temperature of the vapour is measured in the distilling flask itself, whereas the pressure manometer is connected with some other part of the apparatus which is more or less far removed from the distilling flask. With this arrangement it is assumed that the pressure in the distilling flask is the same as that given by the manometer. Strictly speaking, this assumption is never true; in the distilling flask there is a flow of vapour from higher to lower pressures, and the pressure and temperature must vary at different heights above the liquid. These variations will only be noticeable with substances having a high boiling point under very low pressures, and the author shows that in some cases the excess of pressure in the distilling flask may be as much as 3—4 mm., which in the case of a liquid boiling above 200° would cause an error in the boiling point of 3—5° per mm. It follows that in all cases the manometer should be directly connected with the distilling flask.

It is further pointed out that quantitative conclusions cannot be drawn from the results obtained by Krafft and others in their work on distillation in a "cathode light vacuum," since the pressure in the distilling flask must have been much greater than 0·001 mm. It is, in fact, shown that if the pressure were really 0·001 mm., 1 gram of heneicosane would take 44·7 hours to distil, and the amount of vapour present at any time would not be enough to heat the glass and mercury of the thermometer to the temperature of the vapour.

T. S. P.

Dephlegmator with Heated Jacket. Michael M. Tichwinsky (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 386—387).—When 500 grams of caraway oil were distilled with a five-bulbed jacketed dephlegmator, the first fraction contained 3·66% of carvone, the constituent with the higher boiling point, whilst when the distillation was carried out with the same dephlegmator, but in a current of steam, the proportion of carvone in the first fraction was 3·21%. These results compare favourably with those obtained by Schimmel & Co. (Semi-annual *Report*, April, 1908, 161—165) on distilling large quantities of the oil (compare also Hardy and Richens, Abstr. 1907, ii, 531). T. H. P.

Evaporation of Aqueous Solutions. Pierre Vaillant (*Compt. rend.*, 1909, 148, 1099—1102. Compare Abstr., 1908, ii, 460). It has been shown that the addition of sulphuric acid to water does not alter the value of the constant B in the evaporation formula:

$\phi = B.S(F-f)H$, where ϕ is the weight of water evaporated in unit time from surface S, F being the vapour tension of the liquid, f that of the air, and H the barometric pressure. The rate of evaporation of solutions of potassium and sodium hydroxides, phosphoric acid, potassium bromide and iodide, sodium chloride and nitrate, lithium and calcium chlorides, and glycerol has now been measured under exactly similar conditions of surface, and B calculated in each case with the aid of Dieterici's values of the vapour tension of these solutions. With the single exception of potassium hydroxide solutions, the value of B is remarkably constant. Thus the rate of evaporation does not depend on the nature of the solution, but only on its vapour pressure and surface. It is supposed that a layer of saturated air is formed in the immediate neighbourhood of the surface, and that evaporation is regulated solely by the rate of diffusion of the water vapour out of this layer. R. J. C.

Freezing Points of Gaseous Mixtures at very Low Temperatures. GEORGES BAUME (*Compt. rend.*, 1909, 148, 1322—1324).—The author has investigated the freezing-point curves of the following binary systems: methyl ether–hydrogen chloride, methyl ether–sulphur dioxide, methyl ether–methyl chloride.

The curve for the system methyl ether–hydrogen chloride has two maxima, the one (at −94°) corresponding with Friedel's compound OMe_2,HCl, whereas the other, at −102°, corresponds with the formula $OMe_2,4HCl$. The greater part of the curve lying between the two maxima could not be investigated, the mixtures forming uncrystallisable glasses.

Methyl ether and sulphur dioxide form one compound only OMe_2,SO_2, the melting point of which is −91·7°.

The results for the system methyl ether–methyl chloride are to be published later.

Incidentally, the melting points of the pure constituents have been determined as follows: hydrogen chloride, −111°; sulphur dioxide, −72·3°; methyl chloride, −91·5°; methyl ether, −138·5°.

T. S. P.

Freezing of Hydrogels. H. W. FISCHER and O. BOBERTAO (*Biochem. Zeitsch.*, 1909, 18, 58—94. Compare Abstr., 1908, ii, 1024; this vol., ii, 303; Lottermoser, *ibid.*, 27).—Experiments have been made by comparing the thermal effects of plunging tubes containing water and hydrogels in low temperature baths. In each experiment a tube of water (with a cake of gelatin) and a tube containing a gelatin gel were used. The tubes were made from the same glass and were exactly alike; they were placed in a vessel similar to a Dewar flask, and then immersed in a good freezing mixture and allowed to freeze. Differences of temperature in the two tubes were measured by means of a thermo-electric couple and a millivoltmeter. The results are expressed in curves, where the times are plotted against the readings of the voltmeter. They show that at the beginning there is no difference in temperature, then for a few minutes there is a slight difference, but ultimately this disappears. Preliminary experiments, using two tubes containing benzene, gave no temperature differences. Analogous experiments, including determination of both cooling and heating curves, have been made with myricyl alcohol gels.

The general conclusion drawn is that the view that the forces acting between a reversible gel and a liquid are enormous is quite erroneous, and this conclusion is supported by Pauli's experiments on the evaporation of water from gels, and by the authors' experiments on the evaporation of chloroform from a myricyl alcohol gel.

It is also pointed out that the presence of colloids does not appear to favour under cooling. J. J. S.

Phenomena of Condensation for Mixtures of Carbonic Acid and Urethane in Connexion with Double Retrograde Condensation. Philipp Kohnstamm and J. Chr. Reeders (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 11, 913—921).—The pressures corresponding with the co-existence of two liquid phases in the system carbon dioxide–urethane have been determined for temperatures between 26·1° and 37·3°. The phenomena of condensation of carbon dioxide are considerably modified by a very small quantity of urethane, for a mixture containing somewhat less than 0·4% of urethane gives rise to the three-phase system and shows a very pronounced retrograde condensation. H. M. D.

The Conditions Necessary for Direct Reactions, and the Direction of the Electric Current Produced when Metals are Attacked by Sulphur. Albert Colson (*Compt. rend.*, 1909, 148, 1183—1186).—The author demonstrates by the following experiments that if two substances are each capable of combining with a third, the compound formed at a given temperature is not necessarily that with the greater heat of formation. 1. Although the heat of formation of aluminium oxide is much greater than that of copper oxide, when a mixture of the two metals is heated in the air, the copper oxidises first. 2. Copper and silver are readily blackened by sulphur when kept together in a vacuum, whereas aluminium and magnesium are not affected, although the heats of formation of the sulphides of copper and silver are less than those of aluminium and magnesium. The same is true if the metals are suspended in a solution of sulphur in light petroleum. 3. When copper and aluminium form the electrodes in a solution of yellow ammonium sulphide, the copper is attacked; similarly, if the copper is replaced by silver. 4. When copper is brought into contact with sulphur vapour, cupric sulphide is formed, although the heat of formation of cuprous sulphide is much greater than that of cupric.

The author considers that reactions are conditioned at constant pressure by the temperatures at which a compound is formed or decomposed. This range of temperature limits the "zone of reaction" (Abstr., 1899, ii, 205). According to this view thermite reactions do not take place by reason of the great heat of formation of aluminium oxide, but because this oxide is not dissociated at the temperature of reaction (about 2000°), whereas the oxide to be reduced, for example, Cr_2O_3, is dissociated. Thus in non-reversible reactions temperature plays a much more important part than heat of reaction. T. S. P.

Thermochemical Investigations of Organic Compounds. III. Nitrogen Compounds. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 387—429. Compare this vol., ii, 23, 213).—In this paper the author analyses the thermochemical data for nitriles, amines, amides, acetylamino-compounds, nitro-compounds, nitrites, and nitrates. From the available numerical data the following conclusions are drawn.

All the linkings of nitrogen with oxygen and carbon exhibit variable thermochemical functions, their heats of formation increasing with increase of the molecular weight and with change of the structure of the compound in the direction of overloading of the neighbouring spheres surrounding the given unsaturated linking. With progressive increase of the molecular weight, the increases, $d\beta$, $d\mu$, etc., of the heat of formation of the unsaturated atomic linking are not uniform, but depend on the loading of the atoms connected by the unsaturated linking. For instance, $d\beta$ for the linking $C{-}N$ increases considerably if the remaining affinities of the nitrogen atom are satisfied by hydrogen atoms, whilst it is diminished if the primary amine is changed to a tertiary one, in which the nitrogen is loaded with "heavy" radicles.

The heat of neutralisation of the amino-group in an aliphatic chain is considerably less than when the amino-group is attached to an aromatic nucleus; this fact the author regards as due to the equilibrium of the carbon linkings of the nucleus being disturbed.

The law of change of the heat of formation of atomic linkings is confirmed by studying the progressive change from ammonia to primary, secondary, and tertiary amines. Further, the characteristics of the linkings $C{\vdots}N$ and $C{\cdot}N{<}^{C}_{C}$ indicate that change from one class of compounds to another produces some variation in the heats of formation of the atomic linkings, this variation being, however, unimportant; such variation depends on the dynamic influence of the surrounding spheres. These facts indicate the use of the general law of valency of the elements, but also show that this law is valid only in a qualitative sense.

Equations are given expressing the thermochemical characters of the linkings $C{-}C$, $C{-}H$, $C{-}N$, and $N{-}H$, and combinations of these.

The heats of formation of the linking $C{-}N{\ll}^{O}_{O}$ increase with the molecular weight, the formation of the grouping $N{\ll}^{O}_{O}$ from its elements being accompanied by development of heat. Replacement of hydrogen by a radicle causes an increase in the heat of formation of the grouping $-O{-}N{\ll}^{O}_{O}$. The formation of the linking $N{-}O$ from the elements is accompanied by absorption of heat. T. H. P.

Relation of the Surface Tension to the Internal Pressure and to van der Waals' Constants, *a* and *b*. Paul Walden (*Zeitsch. physikal. Chem.*, 1909, 66, 385—444. Compare this vol., ii, 119, 123).—According to Stefan, the work, $(K-p)V$, required to bring particles from the interior to the surface of a liquid is half that required to vaporise them ($K =$ internal pressure, $p =$ vapour pressure of liquid, $V = M/d =$ volume of a molecule of the liquid). Neglecting p in comparison with K, the formula $KV = M\lambda/2$ is obtained, where λ is latent heat of vaporisation of the liquid. Combining this with the equation already deduced for non-associated liquids (*loc. cit.*), $M\lambda/V = 3{\cdot}64\gamma_\sigma$, where γ_σ is the surface tension at the boiling point, the equation $K = 1{\cdot}82\gamma_\sigma$ is obtained; otherwise expressed, the ratio of the internal pressure and the surface tension at the boiling point is constant. An alternative expression for the internal pressure, valid through a wider range of temperature, is $K = 196\gamma_\sigma/\log T_\sigma$, which gives the results in absolute measure. Further, according to van der Waals, $K = a/V^2$, and combining this with an expression for a in terms of T_σ and V_σ, a third expression, $K = 424T_\sigma/V_\sigma$, is obtained for K. The values of K are calculated by means of these three formulæ for a large number of non-associated and associated liquids, and the results are tabulated. Only for non-associated liquids is there fair agreement in the values obtained by the three formulæ, as is to be anticipated from the mode of deriving the latter.

As regards the relationship between internal pressure and chemical constitution for non-associated liquids, it is shown that in any one homologous series an increase of CH_2 always produces approximately the same diminution in the internal pressure, but the magnitude of the diminution is not the same for different homologous series. The halogens and halogen acids have very different internal pressures; the values for the elements, in atmospheres, are as follows: $F_2 = 1060$, $Cl_2 = 2135$, $Br_2 = 2660$, $I_2 = 2830$. On the other hand, the halogens in non-associated organic compounds can be interchanged without altering the internal pressure. The transition from saturated to unsaturated carbon compounds is accompanied by an increase in the internal pressure.

The nature of valency and residual affinity is discussed in this connexion, and it is shown that the greater the attractive forces between the molecules the greater is the internal pressure and also the tendency to association. Further, the greater the internal pressure of the solvent, the greater is its effect in producing simplification or ionisation of the solute. Internal pressure and mutual solubility are also connected; the smaller the difference of the internal pressures of two media, so much the greater is their reciprocal solubility.

The constant a of van der Waals' equation at the boiling point can be calculated in absolute measure by means of the formula $a_\sigma = 424VT_\sigma$. A comparison of the values for non-associated liquids calculated by this formula with the values, a_k, under critical conditions given by Guye and Friderich (Abstr., 1900, ii, 709; 1902, ii, 599) shows that $a_k = 1{\cdot}25a_\sigma$. By making use of this result, the relationships between a_k and the surface tension and heat of evaporation respectively are given by the equations $a_k = 245\gamma V^2/\log T_\sigma$ and $a_k = 25{\cdot}83Vm\lambda$, where the symbols have the usual significance. The values of a_σ thus obtained are not identical with those calculated from van der Waals' equation, but the relationship a_σ/a_1 approximately holds, where a_1 represents the values of van der Waals. For associated liquids, a_k/a_σ is greater than 1·25.

From the known relationships of a and b expressions corresponding with the above are established for b, and are compared with the values obtained by other methods. For non-associated liquids, the expression $b_k = 1{\cdot}26V_\sigma$ holds, but for associated liquids b_k/V_σ is greater than 1·26. The critical pressure, π, can be calculated by means of the formula $V_\sigma\pi/T_\sigma = 12{\cdot}46$, and it is shown that the observed and calculated values are in good agreement.

A number of relationships between the surface tension, the internal pressure, and the critical pressure are deduced and tested. For a wide range of boiling points, the critical pressure, π, can be calculated by means of the formula $\pi = (6{\cdot}5\gamma/\log T_\sigma) - 0{\cdot}102T_\sigma$. Further, the critical pressure is proportional both to the internal pressure and the surface tension, $K/\pi = 34{\cdot}2$ and $\gamma/\pi = 0{\cdot}45$, and the molecular heat of evaporation, $M\lambda = \pi V_\sigma$.

The critical volume is 2·675 times the specific volume at the boiling point. The relationship $V_k\pi/T_k \sim 21{\cdot}8$ is also deduced theoretically; this has already been given by Young and Thomas, and is written by van't Hoff in the form $V_k\pi/T_k \sim 22{\cdot}0$. The experimental data show, however, that this formula is in many cases not valid; it holds approximately for normal liquids, but not for associated solvents or for liquefied gases. A modified form: $(V_k\pi)/T_k = 53{\cdot}5/\log T_k + 0{\cdot}004T_k$, represents the experimental results more accurately. G. S.

An Hypothesis Relative to the Internal Pressure in Liquids.

ÉMILE H. AMAGAT (*Compt. rend.*, 1909, **148**, 1359—1366).—In a preceding paper (*ibid.*, 1135) the author has shown that the total internal pressure of a liquid may be considered as the sum of two pressures, π and π''. Further investigation of the value of π'' shows that it is always negative for all gases, and that it continually increases (negatively) as the volume diminishes. The pressure π'' thus acts in opposition to the molecular attraction and the internal pressure as if it were a perfect fluid (gas) occupying the intermolecular spaces. If this fluid follows Boyle's Law, then at constant temperature: $\pi''(v - \epsilon) = \pi_1''(v_1 - \epsilon) = \ldots$, where ϵ is the volume of the molecules, and $v - \epsilon$, $v_1 - \epsilon$, . . . etc., are the volumes of the hypothetical fluid at pressures π'', π_1'', etc. As the external pressure on the gas increases, ϵ should decrease and finally attain a constant value; this is found to be the case for nitrogen at 0°. For pressures above 1600 atmospheres, ϵ has a value equal to 0·001125. This limiting value is called the co-volume ($=\alpha$), and is independent of the temperature. For pressures where this limiting value holds, π''/π_1'' should equal $(v_1 - \alpha)/(v - \alpha)$, and this is demonstrated to be true.

Taking into account the variation of π'' with the temperature. keeping the volume constant, and assuming that the hypothetical fluid behaves as a perfect gas, it is shown that $1/273v - dp/dt = 1/273(v - \alpha)$, and this is found to be true for nitrogen for pressures where ϵ has its limiting value ($=\alpha$).

Similar results have been found with carbon dioxide, ethylene, oxygen, air, and ether.

Theory shows that if equal volumes of different gases are compared under the same conditions of temperature and (low) pressure, the internal pressure should be proportional to the square of the molecular weight of the gas. The experimental results, however, are not in accord with the theory. T. S. P.

Internal Pressure of a Gas. Anatole Leduc (*Compt. rend.*, 1909, **148**, 1391—1394).—Utilising the formulæ given in a previous paper (*ibid.*, 1174), the author has calculated the internal pressures of eighteen different gases under normal conditions, that is, for external pressures less than three atmospheres. This internal pressure is not found to be proportional to the square of the molecular weight of the gas, as it theoretically should be.

A comparison at 15° of ammonia and the methylamines shows that the substitution of CH_3 for H increases the internal pressure by 21·1-thousandths of an atmosphere.

In the case of acetylene and benzene at 129·6° and atmospheric pressure, the ratio of the internal pressures is found to be 10·1, which is approximately equal to the ratio of the square of the molecular weights of these substances. The deviation is probably due to the different complexities of the molecules. T. S. P.

Van der Waals' Equation of Condition and the Solid State. Isidor Traube (*Ber. Deut. physikal. Ges.*, 1909, 231—236).—From van der Waals' equation the author deduces that the product of the internal pressure and the square root of the atomic (or molecular) compressibility should be approximately constant. As in a previous paper (Abstr., 1903, ii, 355), the equation is applied to the solid state, and by making use of the compressibility values given by Richards, the author finds that the above product is very nearly constant for fourteen elements in the solid state. The higher value obtained in the case of iron is attributed to the great influence exerted by small traces of foreign substances on the internal pressure. H. M. D.

Influence of Temperature on the Change of Volume on Neutralisation for Various Salts at Different Concentrations. Ida Freund (*Zeitsch. physikal. Chem.*, 1909, **66**, 555—613).—The measurements were made by Ostwald's method, a special form of Sprengel pyknometer, which proved very suitable for experiments extending through a wide range of temperature, being used for the density measurements. The changes of volume on the formation of the chlorides and nitrates of potassium and sodium, of ammonium chloride, and of the acetates and fluorides of potassium and ammonium, have been calculated from the density determinations for a series of temperatures between 0° and 100°, and for 0·125 to 2*N* solutions (in the case of the ammonium salts only up to 0·25 normal solution), and the results are expressed graphically and in the form of tables. In the first place the measurements were expressed in gram equivalents per kilo. of solution, but they are also approximately calculated for gram-equivalents per kilo. of solvent. The average accuracy is 3 in 100,000; above 70° the experimental difficulties become much greater.

In agreement with the results of previous observers, it was found that $\Delta v/c$ (where Δv is the change of volume and c is the concentration) increases with dilution, and approaches a limiting value independent of the nature of the salt. The influence of temperature is greater the more dilute the solution. For the chlorides and nitrates of potassium and sodium, $\Delta v/c$ diminishes at first with increase of temperature, attains a minimum value, which in the most dilute solutions lies at 45°, and beyond that point increases with the temperature. On the other hand, the changes of volume for the salts of weak acids and the ammonium salts diminish regularly with increase of temperature.

The theoretical bearing of the changes of volume with the concentration and the temperature are discussed, mainly with reference to Tammann's views as to the connexion of these factors with the internal pressure of the respective solutions. G. S.

Relation between the Orthobaric Densities of Homologues. G. Ter Gazarian (*J. Chim. Phys.*, 1909, 7, 273—288. Compare Abstr., 1908, ii, 666).—From a study of the experimental data of Young and his co-workers, it is shown that for the members of a homologous series the densities corresponding with temperatures distant the same number of degrees from the critical temperature differ only by a factor. For example, if d is the density of pentane at the temperature t, the density d' of one of its homologues at the temperature $t+\theta$ (where θ is the difference in the critical temperatures of pentane and the other substance) is given by the formula $d'=d+(d'_c-d_c)-at$, where d'_c and d_c are the critical densities of pentane and its homologue, and a is the factor referred to above; a varies from one natural group to another, and in some cases is zero. Its value increases with the molecular weight of the homologues.

The above rule is tested by application to the experimental data for certain hydrocarbons and esters, the results being given in tabular form. In the case of esters, a is practically zero.

A similar rule appears to hold for viscosities; the details will be given in a later paper. G. S.

Adsorption by Clays. Paul Rohland (*Biochem. Zeitsch.*, 1909, 17, 220—224. Compare this vol., ii, 27; Michaelis and Rona, this vol., ii, 125).—Kaolin ($Al_2O_3,2SiO_2,2H_2O$), of all the clays, is least suited for adsorption experiments. The plasticity is very small, and likewise the tendency to form colloidal hydroxides, which in reality bring about the adsorption of proteins. Better suited are dark-coloured plastic clays, which form a large proportion of these colloidal hydroxides on contact with water, and are characterised by a loss of 12% or more on ignition. Such clays absorb a large number of substances possessing colloidal characters, and absorb further some crystalloids, in particular, dyes of complicated nature, such as Prussian- or Turnbull's-blue, aniline, and animal dyes, but not simple substances such as copper sulphate or potassium dichromate. They further absorb carbonates, and to some extent phosphates, but allow other simple salts to diffuse.

The colloidal hydroxides of silicon, aluminium and iron, and the organic colloids of the clays, are regarded as forming a complicated network of cellular structure, and presenting a very large number of dividing surfaces, whereas a compact crystalloid substance only presents one such surface. It is to be supposed that the meshes of the coagulated colloidal network swollen with water molecules are too fine to allow coarse colloid molecules to diffuse through them, but they are large enough to allow the passage of the much smaller crystalloid molecules. The more complicated a substance is the more readily it will be adsorbed; compounds will also be more readily adsorbed from concentrated solution in which their molecules are aggregated to complexes than in dilute solution in which they are probably dissociated.

E. F. A.

Adsorption by Means of Clay. Leonor Michaelis and Peter Rona (*Biochem. Zeitsch.*, 1909, **18**, 207).—The authors point out that Rohland (preceding abstract) had misquoted from their original paper (compare this vol., ii, 125).

J. J. S.

Relation between Density and Degree of Dissociation of Aqueous Solutions. S. Tereschin (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, ii, 155—160; *Ber. Deut. physikal. Ges.*, 1909, 211—214).—It has been shown by Heydweiller (*Ber. Deut. physikal. Ges.*, 1909, **11**, 37) that for a large number of salts the excess, $s-1$, of the density of the solutions over that of water at the same temperature may be calculated by means of the formula: $(s-1)/m = A_s i + B_s(1-i)$, where m represents the number of gram-mols. per litre, i the degree of dissociation, and A_s and B_s constants independent of the concentration.

For Heydweiller's two constants, A_s and B_s, the author derives the equations: $A_s = N.(\mu' - \mu'_0)/1000m + N.(\mu'' - \mu''_0)/1000m$ and $B_s = N.(\mu - \mu_0)/1000m$, in which N represents the number of gram-mols. of a binary electrolyte per litre, μ_0 the mass of the solvent in the volume of the spheres of action of the molecules, and μ the mass of all the molecules with the mass of the layers of solvent of changing density surrounding them; μ'_0 and μ' represent the corresponding magnitudes for one ion, and μ''_0 and μ'' for the other. The values of A_s and B_s calculated in this way for a large number of salts are in good agreement with the experimental values.

T. H. P.

The Diametral Line of Acetylene. Émile Mathias (*Compt. rend.*, 1909, **148**, 1102—1105).—The densities of liquid acetylene and its saturated vapour have been determined with an accuracy of 1 in 5000 at temperatures ranging from $-23{\cdot}75°$ to $+32{\cdot}93°$. The mean of the two densities at each temperature obeys the Cailletet-Mathias law, its graph being a rectilinear diameter to the density curve. In spite of the unsaturated character of acetylene, there is little sign of abnormally high density at low temperatures, such as is met with in the substituted ammonias. The critical temperature of acetylene was found by Young's method to be $+37{\cdot}05°$ or $310{\cdot}05°$ absolute ($=\theta$). The critical density calculated by the mean density law is 0·2346 ($=\Delta$). The angular coefficient a of the mean density graph is 0·00064.

If the law of corresponding states holds for the density curves of all substances, the constants $a(=a.\theta/\Delta)$ and $b(=-a\sqrt{\theta}/\Delta)$ should be independent of the nature of the substance. The values of a and b in the case of acetylene are 0·8605 and 0·0489, whereas carbon dioxide gives 0·858 and 0·0493. Thus, in the case of acetylene and carbon dioxide, the critical temperatures of which are very close together, the law of corresponding states holds, in spite of the difference in constitution of the two molecules. R. J. C.

Theory of Organic Bases Based on the Viscosity of their Solutions. D. E. TSAKALOTOS (*Compt. rend.*, 1909, **148**, 1324—1326).—In aqueous solution organic bases are supposed to combine with a molecule of water, the resulting compound, or aquobase, then dissociating to a greater or lesser extent with the formation of hydroxidions. From measurements of other observers on the viscosities of aqueous solutions of various bases, the author deduces that combination between the base and water does take place, and hence support is given to the theory mentioned.

Aqueous solutions of triethylamine, pyridine, piperidine, and nicotine each give solutions possessing a maximum viscosity, and this maximum viscosity is considered to point to the formation of a definite compound between the water and the base. T. S. P.

Contribution to the Study of Capillarity. PIETRO PALLADINO (*Chem. Zentr.*, 1909, i, 973; from *Giorn. Farm. Chim.*, 1909, **58**, 5—6).—The rising of the capillary meniscus when a solid is wetted by a liquid indicates a pressure between the solid and the liquid substance. A solid substance inserted in two liquids remaining in layers one on the other, causes the under liquid to form a convex meniscus at the point of contact of the two liquids. The nature of the solid substances influences the meniscus; methylene dibromide or di-iodide under water gives a convex meniscus with quartz, glass, mica, magnesium, aluminium, etc., and concave with platinum, gold, lead, zinc, tin, copper, etc. The same solid substance may give a different meniscus according to the nature of the lower liquid; thus, methylene dichloride under water gives with magnesium or aluminium a concave meniscus. When the lower liquid is made up of two miscible components, which by themselves give different forms of meniscus, according as one or the other substance predominates, so is the meniscus changed. Although in saturated solutions the meniscus is practically reduced to nothing, the presence of solid or gelatinous substances does not produce a reverse effect. J. V. E.

"Dynamic" Osmotic Pressures. EARL OF BERKELEY and ERNALD G. J. HARTLEY (*Proc. Roy. Soc.*, 1909, **82**, *A*, 271—275).—The rate at which water passes through a copper ferrocyanide membrane into solutions of sucrose has been measured, and compared with the rate at which known hydrostatic pressures force water through the membrane. The measurements of the osmotic flow refer to the initial velocity, for it is found that this diminishes considerably when the membrane is allowed to remain in contact with the solution. In order to prevent local changes of concentration, the solutions were efficiently stirred.

For the hydrostatic flow the velocity is proportional to the pressure. When the rates of osmotic flow are divided by the rate of hydrostatic flow for a difference of pressure of one atmosphere, the so-called dynamic osmotic pressures of the various sucrose solutions are obtained. For dilute solutions, these pressures agree fairly well with the equilibrium osmotic pressures, but for the more concentrated solutions the dynamic values are considerably smaller than the equilibrium values. The experiments indicate that osmotic phenomena can be measured kinetically, and that for dilute solutions the results are the same as when measured statically. H. M. D.

Osmotic Pressures of Calcium Ferrocyanide Solutions. II. Weak Solutions. Earl of Berkeley, Ernald G. J. Hartley, and J. Stephenson (*Phil. Trans.*, 1909, *A*, 209, 319—336. Compare this vol., ii, 126).—The osmotic pressures at 0° of calcium ferrocyanide solutions of from 7 to 21·8% strengths were measured in the apparatus described previously with addition of a more sensitive pressure gauge, since the pressures measured did not exceed 25 atmospheres.

It was found that the osmotic pressure of 7% and 12·2% solutions agree very well with those calculated on the assumption that the gas laws hold for solutions, whereas 17·6% and 21·8% solutions give values higher than the calculated. As this is the reverse of what would be expected on the dissociation hypothesis, the osmotic pressures of dilute solutions of strontium ferrocyanide and potassium ferrocyanide were also measured. Potassium ferrocyanide in accordance with current theory gives osmotic pressures which diverge more and more from the calculated as the solution is diluted, until at 1·5% strength the salt appears to be dissociated into three ions or molecules. On the other hand, strontium ferrocyanide, the crystals of which contain $14H_2O$, exhibits the same anomaly as the calcium salt, but somewhat more markedly, the osmotic pressure in 6·18% solution being actually less than the calculated. A few measurements were made of the osmotic pressures of magnesium camphorate, potash alum, sodium and calcium naphthionates, barium, lead, and potassium benzenesulphonates, barium *o*-nitrobenzoate, luteocobalt chloride, and calcium acetate, all of which behave normally, giving in dilute solution osmotic pressures in excess of the calculated.

The conductivities of calcium and strontium ferrocyanide solutions from about 20% strength down to a high dilution were carefully measured by the Fitzpatrick and Whetham commutating method at 0°. The equivalent conductivities of these salts show a steady increase, until at infinite dilution the equivalent conductivity is about five times that of a 20% solution. The normal electric and abnormal osmotic properties of calcium and strontium ferrocyanides may be explained as due to (1) association to double molecules which are ionised, and (2) ionisation with subsequent association of the ions to complexes. On the former assumption, allowing for ionisation, the calculated osmotic pressures are in equally satisfactory agreement with experiment whether it be supposed that five or six ions are formed from the double molecule. Erlenmeyer's formula (1865) for the ferrocyanides appears best to express the constitution: $[Ca(CN)_3]_2Fe = Fe[(CN)_3Ca]_2$, the ions being $4\overset{+}{Ca}$ and $2\overset{-}{Fe}(CN)_6$ or $4\overset{+}{Ca}$ and $\overset{-}{Fe_2}(CN)_{12}$.

Erlenmeyer's formula in the case of potassium ferrocyanide requires nine or ten ions, and leads to values of the osmotic pressure which are also in tolerable agreement with the experimental ones. Quantitative agreement is not to be expected in view of the assumptions made.

The evidence is held to prove that calcium and strontium ferrocyanides, at least, are associated in solution, although tetraethyl ferrocyanide is known to have the single molecule $Et_4Fe(CN)_6$ (compare Buchböck, Abstr., 1897, i, 452). R. J. C.

The Measurement of Osmotic Pressure. JOSEF KÖNIG and J. HASENBÄUMER (*Zeitsch. angew. Chem.*, 1909, 22, 1009—1018, 1070—1074. Compare Abstr., 1908, ii, 888).—The primary object of the authors was the measurement of the osmotic pressures of different soils, but the present paper is mainly concerned with the apparatus used and the results obtained with different inorganic and organic compounds. A satisfactory semi-permeable membrane was formed in the walls of a porous pot, according to a modification of the method used by Walden (Abstr., 1893, ii, 203). The pot, after being cleaned in the usual manner and heated in a drying oven, was filled with a hot 6% solution of gelatin; as soon as the solution had penetrated to the outside, the pot was emptied, washed with hot water, and treated with formaldehyde vapour in order to harden the gelatin. The semi-permeable membrane of copper ferrocyanide was then deposited in the walls of the pot in the usual manner, full particulars being given in the original paper. Pots which have been prepared in this way can be used over and over again for osmotic experiments if care is taken to clean them by repeated treatment with water between each set of experiments, any gelatin which has become soluble being hardened by fresh treatment with formaldehyde.

In the first set of experiments the osmotic cell was connected with an open manometer in the usual manner, and measurements were made with dilute solutions of sodium nitrate, potassium nitrate, potassium chloride, potassium sulphate, ammonium sulphate, magnesium sulphate, and sucrose in order to test the membrane. The experiments were made at room temperature, and the results were in good agreement with those obtained by Pfeffer (*Osmotische Untersuchungen*, 1877).

For experiments with soils it was necessary to use the osmometer in a different way. In place of the open manometer was a U-tube and goose-neck, the latter containing oil of known density. The cell and its contents were placed in water, and the quantity of water entering the cell was measured by weighing the oil expelled from the goose-neck, the weighings taking place every twenty-four hours. The contents of the cell consisted of soil saturated with water, asbestos being added to prevent the soil caking together. Tests on six different soils, varying in nature from a sandy soil to a shaly one, gave fairly concordant results for the "osmotic water absorption" in twenty-four hours.

Further experiments were made with different inorganic and organic salts and organic compounds (chiefly sugars) in order to test the method of "osmotic water absorption." It was found that equimolecular solutions show the same osmotic water absorption, allowance of course being made for dissociation in the case of salts. The salts of the fixed alkalis, such as potassium sulphate, diffuse through the membrane to a much greater extent than ammonium and magnesium sulphates.

In the last part of the paper the "osmotic water absorption" is used to determine the molecular weights of various sugars and dextrins, either dextrose or raffinose being taken as the normal substance. Good results could only be obtained when the temperature was kept constant at 25°. Stachyose was found to be $C_{18}H_{32}O_{16},3H_2O$. The following multiples of $C_{12}H_{20}O_{10}$ were found for the dextrins named: Acid achroodextrin I + $\frac{1}{3}$ achroodextrin II, 5; Erythrodextrin II*a*, 11; Erythrodextrin (SreEnI′), 13; diastatic achroodextrin, 8.

The apparatus can also be conveniently used for determining the isotonic coefficients of salts. T. S. P.

Velocity of Molecular and Chemical Reactions in Heterogeneous Systems. I. Meyer Wildermann (*Zeitsch. physikal. Chem.*, 1909, 66, 445—495. Compare Nernst and Brunner, Abstr., 1904, ii, 315; Bruner and Tolloczko, Abstr., 1901, ii, 10; 1902, ii, 62; 1903, ii, 470).—An adverse criticism, based both on theoretical and experimental grounds, of Nernst's diffusion theory of reaction velocities in heterogeneous systems. Nernst's equation is a special form of the author's general equation: $dt/d\tau = C\Sigma_\tau(t_0 - t)$ (compare Abstr., 1900, ii, 200; 1901, ii, 544), which indicates that the reaction velocity at the time τ is proportional to the distance of the system from equilibrium $(t_0 - t)$ and to Σ_τ, the total surface in contact of the reacting parts of the heterogeneous system, but the interpretation of the factors given by Nernst is not justified.

The experimental part deals mainly with the rate of dissolution in water of benzoic acid and of a number of varieties of calcium sulphate. The materials were compressed under several thousand atmospheres' pressure, and were then found to dissolve uniformly. It was, however, found impossible to compress pure magnesium hydroxide so as to form a block which did not disintegrate when placed in water, and the author considers that the hydroxide used by Nernst and Brunner was contaminated with carbonate.

The measurements were made in a large beaker containing 1500 c.c. of water, which was placed in a bath at constant temperature. A double stirrer was used, and the block of material was fastened to the stirrers and rotated with them. Great precautions were taken to secure a uniform rate of stirring, and the methods employed for this purpose are fully described. In the case of benzoic acid, the rate of dissolution was measured by titrating a portion of the solution from time to time. For calcium sulphate, the rate of change of the conductivity of the solution was measured. The constants were calculated by means of the general formula given above.

The effect of temperature on the rate of solution of benzoic acid has been measured between 1° and 60°. The results are calculated by means of the formula: $\log.k_0 - \log.k_1 = A(T_0 - T_1)/T_0T_1$, which is valid for homogeneous systems. Between 1·5° and 17·5° A increases by 5·1%, and between 40° and 60° by 3·64% per degree. As the rate of increase of diffusion with temperature is only 2·5% per degree, this is regarded as a strong argument against the diffusion theory. The rate of solution increases proportionately with the stirring from 3 to 180 turns per minute, beyond this point it falls off, and above 400 turns attains a maximum value, independent of further increase in stirring. The greater the solubility the more rapidly is the maximum reached.

The rate of dissolution of three varieties of calcium sulphate, selenite, fibrous gypsum, and alabaster, under comparable conditions are in the ratio 1 : 3·5 : 5·4, whereas according to the diffusion theory they should be identical. Sections of selenite cut at right angles to each other give for the respective rates of solution 3·376 : 0·6378. Powdered and compressed selenite and powdered and compressed gypsum dissolve at the same rate.

As regards the theoretical objections to the diffusion theory, it is pointed out that Nernst's assumption of "infinitely great" forces acting at surfaces of contact is untenable, (1) because then the rate of evaporation of a liquid should be very rapid, whereas it is very slow; (2) molecules in contact, such as those of aniline and acetic acid, should react with very great velocity, which is contrary to fact. The author considers that the "diffusion layer" in contact with the solid does not exist, and that efficient stirring moves the solution in contact with the solid up to molecular distance from the latter. G. S.

Temperature-coefficient of Chemical Reaction Velocities. II. The Physical Meaning of the Chemical Reaction Velocity in Gases and its Calculation from Purely Thermal Data Pertaining to the Reacting Substances. MAX TRAUTZ (*Zeitsch. physikal. Chem.*, 1909, **66**, 496—511. Compare Abstr., 1908, ii, 824).—By a thermodynamical method a very complicated expression is derived for the temperature-coefficient of the reaction velocity in terms of the heat of formation from the atoms, vapour pressures, and molecular heats of the condensed components, and another expression is given for the velocity constant in terms of the same thermal factors, the time, and an unknown integration constant. The available data are not sufficient to admit of the formulæ being tested by application to special cases, but it is shown that they are in general agreement with the experimental results. G. S.

Chemical Action in Gaseous Mixtures Submitted to very High Pressures. E. BRINER and A. WROCZYNSKI (*Compt. rend*, 1909, **148**, 1518—1519 *).—In highly compressed gaseous mixtures at relatively low temperatures, since the atoms are very close together, the conditions are those where chemical attraction will exert its maximum effect and exothermic actions may be accelerated. The mixtures nitric oxide–carbon monoxide, nitric oxide–hydrogen chloride, and nitric oxide–sulphur dioxide at 50 atmospheres retain their normal character. If, however, they are condensed in liquid air in stout glass tubes which are two-thirds filled and then sealed off, a pressure of more than 500 atmospheres is reached when the liquids are allowed to warm up beyond their critical point and chemical action at definite rates takes place. The mixture nitric oxide–hydrogen chloride condenses in liquid air to a deep reddish-violet solid, doubtless an additive compound. At the ordinary temperature, the highly compressed mixture is a colourless gas, which after a time deposits two liquids layers gradually increasing from day to day. The pale red layer is nitrosyl chloride, and the pale yellow layer is water containing dissolved nitrosyl chloride. The action $4NO + 4HCl \longrightarrow 2NOCl + 2H_2O + Cl_2 + N_2$ is strongly exothermic. If the tube contains excess of nitric oxide, the two liquid layers are slowly converted into one deep green liquid of unknown composition.

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* and *Zeitsch. anorg. Chem.*, 1909, **63**, 49—52.

The system $NO + SO_2$ gives rise under high pressure to a pale green solid, which is stable at ordinary pressures and apparently consists of nitric oxide dissolved in sulphur trioxide, formed according to the exothermic equation $2NO + 2SO_2 \longrightarrow 2SO_3 + N_2$. The mixture hydrogen chloride–sulphur dioxide condenses to an orange-yellow additive compound in liquid air. The beginnings of chemical action have been observed in the systems hydrogen chloride–sulphur dioxide, nitric oxide–methyl chloride, and sulphur dioxide–oxygen at high pressures.

R. J. C.

The System Water–Liquid Ammonia. Agreement of the Results with the Existence of a Hydrate of Ammonia. E. Baud and L. Gay (*Compt. rend.*, 1909, **148**, 1327—1329).—In order to determine what hydrates exist in aqueous solutions of ammonia, the heat developed by mixing water and liquid ammonia in different proportions has been measured. This was effected by measuring the heats of dilution of the various mixtures, and of anhydrous liquid ammonia, in a large excess of water.

The curve showing the relation between the heat developed and the percentage composition of the mixture shows a maximum which corresponds with the composition $NH_3,1{\cdot}109H_2O$.

When water and liquid ammonia are mixed, contraction takes place; the maximum contraction occurs with the mixture of composition $NH_3,0{\cdot}9H_2O$.

The above results point to the existence of a hydrate, NH_3,H_2O.

The heat of solution of 1 gram-molecule of liquid ammonia in water at 12° is found to be 3·485 Cals.

T. S. P.

Equilibrium in the System Ammonium Sulphate, Ammonium Chloride, Ethyl Alcohol, and Water. J. P. Wibaut (*Chem. Weekblad*, 1909, 6, 401—409).—The author has examined the system ammonium sulphate, ammonium chloride, ethyl alcohol, and water. His results are expressed by Schreinemakers's graphic method, a tetrahedron, the angles representing the components.

A. J. W.

Chemical Affinity in Reversible Systems. H. Goldblum (*J. Chim. Phys.*, 1909, **7**, 289—336).—The general formulæ for the representation of chemical affinity are tested on the basis of an experimental investigation of the reversible reaction: $BaCrO_4 + K_2CO_3 \rightleftarrows BaCO_3 + K_2CrO_4$, already investigated by Guldberg and Waage. It is shown by Berthelot's rule that the left-hand system is the more stable, as its heat of formation exceeds that of the system on the right hand by 6·4 calories, and the same conclusion is reached by a consideration of solubilities, the solubility product of the substances on the left-hand side being about one-tenth of that on the right.

The equilibrium diagram of the system has also been constructed. On the basis of the phase rule, there are four points at which the system is univariant, and the positions of these points have been determined by solubility measurements in the usual way. The points represent solutions saturated with reference to the salts as follows: (*A*) potassium and barium chromate; (*B*) potassium and barium chromate and potassium carbonate; (*C*) potassium and barium carbonate and barium chromate, (*D*) potassium and barium carbonate. Measurements were made at 25°, and for *B* and *C* also at 40°.

Further, solubility determinations have been carried out in which solutions containing different molar proportions of potassium chromate in water have been shaken with barium carbonate until equilibrium was attained, and the solutions then analysed; similar measurements were made with solutions of potassium carbonate and solid barium chromate, so that the equilibrium was reached from both sides. From the results, the equilibrium constant $K = [K_2CO_3]/[K_2CrO_4]$ has been calculated, and it is shown that K is not constant; it decreases at first with the concentration, reaches a minimum value, and beyond that point increases. The deviation from the simple law is ascribed to the electrolytic dissociation of the salts, and the modifications required to take ionisation into account are considered.

From the values of the equilibrium constant at 25° and 40°, the heat of the reaction is calculated by van't Hoff's formula; it amounts to 5997 calories, in fair agreement with the value, 6400 calories, calculated according to Hess's law. G. S.

Certain Deductions for Quaternary Systems. FRANS A. H. SCHREINEMAKERS (*Zeitsch. physikal. Chem.*, 1909, 66, 699—704).—A method for the graphic representation of quaternary systems is described, and illustrated by application to the system:

$$H_2O-CuSO_4,5H_2O-Li_2SO_4-(NH_4)_2SO_4.$$

G. S.

Kinetics of the Hydrolytic Decomposition of Methyl Acetate by the Catalytic Action of Acetic Acid. KOZO IKAWA (*Mem. Col. Sci. Eng. Kyōto*, 1908, i, 320—324).—Ostwald found that the "constants" for the hydrolytic decomposition of methyl acetate by acetic acid diminished somewhat during the action, a result which he ascribed to vaporisation of the ester during the very slow reaction. The author has carried out the reaction in closed vessels, the rate being deduced from electrical conductivity measurements made at intervals up to thirty-five days for a single experiment, and obtains good constants. G. S.

Kinetics of two Simultaneous Reactions in a System. Kozo Ikawa (*Mem. Col. Sci. Eng. Kyōto*, 1908, 1, 375—385).—It is shown that when mixtures of methyl and ethyl acetate, and of ethyl acetate and butyrate, undergo hydrolysis in the presence of hydrochloric acid in a dilute aqueous solution, the reactions exert no mutual influence.

G. S.

Catalysis by Moisture. J. Meynier (*Compt. rend.*, 1909, 148, 1516—1517).—Langevin demonstrated that the atmosphere contains ions which are drops of liquid water of the order 1/100 of a micron in diameter, and that these can be removed by filtration through cotton wool. The part played by moisture in the explosion of hydrogen and oxygen, the oxidation of nitric oxide, etc. (compare Brereton Baker, Trans., 1902, 81, 400), might be ascribed to these ions. The author mixes steady streams of nitric oxide and oxygen in equivalent proportions by means of a Y-tube, and measures their speed of combination by the temperature attained at a fixed point further along the tube. Neither drying the gases by means of fused potash and phosphoric oxide nor filtration through 30 cm. of cotton wool have any effect on the rate of combination. It follows that gaseous water alone brings about the action—the speed of which, however, is not proportional to the amount of water, but attains its full value in presence of the merest trace. R. J. C.

Determination of Solubility by means of Pulfrich's Refractometer. II. Yukichi Osaka (*Mem. Col. Sci. Eng. Kyōto*, 1908, 1, 290—303).—The results of further solubility determinations by the refractometer method already described (Abstr., 1907, ii, 934) are given. The applicability of the formula $ax + bx^2 = d - d'$ to the observations is confirmed.

The solubility of certain compounds in water at 25°, expressed in grams per 100 grams of water, is as follows: mercuric chloride, 7·42; sodium chlorate, 101; sucrose, 212; disodium hydrogen phosphate (as anhydrous salt), 12·2; borax (as anhydrous salt), 3·33. The following results are expressed in grams per 100 grams of solution: mercuric chloride in 99·2% alcohol, 33·8; coumarin in chloroform, 49·4; benzophenone in benzene, 78·6; mercuric chloride in a normal aqueous solution of sodium chloride, 25·08; sodium chloride in water, 26·5 (36·0 in 100 grams of solvent); potassium sulphate in water, 10·72 (12·0 in 100 grams of solvent). The agreement of the observed and calculated values of x for mercuric chloride in a solution of sodium chloride indicates that the formula holds even when a chemical reaction occurs in solution. A method is described by which the formula, the constants of which have been determined for a particular temperature, may be used for observations at other temperatures.

G. S.

Relations between Density and Crystallographic Constants in Certain Groups of Substances. Luigi Colomba (*Atti R. Accad. Sci. Torino*, 1909, 44, 399—434).—If the molecule M of any substance is composed of a definite number, n, of groups r', r'', . . . r^n, and

V be its molecular volume and $v', v'', \ldots v^n$ the molecular volumes of the component groups, then, if there is no modification of molecular volume in passing from the components to the molecule, $V = v' + v'' + \ldots v^n = \Sigma v^n$. If V is less or greater than Σv^n, there is said to be positive or negative deformation. The ratio $A = \Sigma v^n/V$ is termed the index of deformation of volume.

With certain groups of cubic substances, the values of the indices of deformation approximate to the numbers 1·60, 1·075, and 0·93. Thus, for the series CaS, SrS, BaS, MgS, Li_2S, and NiSe, taking v' to be the atomic volume of the sulphur or selenium and v'' that of the metal, and calculating the density of the compound on the assumption that the index of deformation is 1·60, numbers are obtained in good agreement with the experimental densities. The same is the case with the series galena, argentite, zinc blende, alabandite, Cu_2S, naumannite, berzehanite, ZnSe, and MnSe, in which the index of deformation is equal to 1·075.

A group in which the deformation is negative is that of the spinels, the index of deformation being 0·93. With these substances v' is taken as the molecular volume of the sesquioxide, Al_2O_3, etc., and v'' as that of the basic oxide, MgO, etc. Excepting in the cases of jacobsite, which always contains an appreciable proportion of magnesium, and of the zinc compounds, $ZnAl_2O_4$ (gahnite), $ZnFe_2O_4$, and $ZnCr_2O_4$, with which slight discrepancies occur, the calculated and observed densities are in good agreement.

The second value given for A, 1·075, is almost exactly two-thirds of the first, 1·612, whilst the third, 0·93, is the reciprocal of the second, 1·075. To these the author adds a fourth, 0·62, the relations between these four values being given by the equations: $A_1 = 1{\cdot}075$; $A_2 = 3A_1/2 = 1{\cdot}612$; $A_3 = 1/A_1 = 0{\cdot}930$, and $A_4 = 2/3A_1 = 0{\cdot}620$. If the cubic system is taken to be a special case of the rhombohedral, the value of the angle $0001 : 10\bar{1}1$ in the general equation

$$c = \tan(0001 : 10\bar{1}1)\sqrt{3}/2$$

becomes 54°44′, and the value of c becomes $\sqrt{3}/2$ or 1·2246. Now, taking cA_1 to be constant, the latter will have the value 1·316, which will also be the value of A_2/c, c/A_3, and $1/cA_4$. All the cases in the cubic system are hence referable to the general equation:

$$C = \text{const. } xf(R),$$

in which C is made equal to c, and the values found for the indices of deformation are substituted for $f(R)$.

These principles are extended to other groups of compounds crystallising in other systems. For details the original must be consulted.

T. H. P

New Proof of the Existence of Molecules. II. THE SVEDBERG (*Zeitsch. physikal. Chem.*, 1909, 66, 752—758).—The measurements described in the previous paper (this vol., ii, 277) have now been extended to colloidal solutions of ferric hydroxide and of arsenious sulphide, and the results confirm the conclusions already given. Some further experiments with colloidal gold are described.

G. S

New Atomic Theory. JAMES MOIR (*J. Chem. Metal. Min. Soc. S. Africa*, 1909, 9, 334—341).—It is suggested that the atoms are built up of different arrangements of four or five primary materials, and the structural formulæ are so selected as to give the best possible agreement with all the known chemical and physical properties of the atoms. It is assumed that the carbon atom is made up of four similar sub-atoms of atomic weight 3, arranged tetrahedrally, and these sub-atoms, termed zoïkon (symbol z), represent one of the primary materials. The second sub-atom is hydrogen, which is assumed to possess an intrinsic, repulsive force, and the third is a hypothetical element of atomic weight 2, symbol x, univalent like hydrogen, yet not fully saturating another element when joined to it. Helium (at. wt. = 4·09) and neon (at. wt. = 19·7) complete the list of primary elements. Further, it is assumed that the metals contain hydrogen as the cause of their electro-positive character, and that the sub-atom x confers an electro-negative character.

It is shown how all the other elements can be built up from these five primary materials, and many of the formulæ are illustrated graphically. Nitrogen is z_4x, the x being placed differently with reference to the carbon tetrahedron, according as the nitrogen is bivalent or quinquevalent. Oxygen is z_4x_2, fluorine, z_3x_5, and lithium, H_2xz. The theory may afford satisfactory explanations of certain isomeric changes. G. S.

Reform of Chemical and Physical Calculations. C. J. T. HANSSEN (*Chem. News*, 1909, 99, 229).—The author states that Hinrich's discovery of the atomic weight of pantogen has enabled him to prove that the atomic weights of the elements are exact multiples of the atomic weight H = 1, and that the proportion H = 1 : O = 16 is absolutely correct. J. V. E.

Mathematically Harmonising the Elements. F. H. LORING (*Chem. News*, 1909, 99, 241—242. Compare this vol., ii, 392).—The present communication deals with certain interesting chemical regularities amongst the elements when classified by the author's method. Acidic and peroxide regularities, a specific heat sequence, and also the position of the magnetic elements are considered. The theory of satellites is found to be too hypothetical to be seriously entertained without the support of experimental evidence, and the figure 0·2684 previously given (*loc. cit.*) must be only regarded as roughly approximate. J. V. E.

Chance Identity of Numbers with Atomic Weights and Approximate Agreement with Mendeléeff's Series. PIETRO PALLADINO (*Chem. Zentr.*, 1909, i, 970—971; from *Giorn. Farm. Chim.*, 1909, 58).—The author explains the existence of definite simple forms of aggregations of material particles by the assemblage of spheres. Four spheres closely packed give a tetrahedron, the addition of six more gives another tetrahedron, etc., leading to a series of tetrahedra. In addition to this simple form, several others are given, namely, octahedron, regular tetrahedron with truncated edges, six faced double pyramid with triangular base, the pyramid having truncated edges; from combinations of these fundamental forms all others may be derived. The number of spheres in the simplest aggregation is called the *absolute weight*, and by dividing this number for every series of different forms by 1/16 of that aggregation which corresponds with oxygen ($O : 16 = 3274{\cdot}625 = M$), numbers are obtained which agree with the atomic weights, and the order followed is approximately that of Mendeléeff. J. V. E.

True Atomic Weights. Stas' Determinations. LOUIS DUBREUIL (*Bull. Soc. chim.*, 1909, [iv], 5, 604—610, 610—613. Compare this vol., ii, 475).—In these two papers the method of calculating atomic weights already outlined (Abstr., 1908, ii, 936), based on that of Hinrich's (Abstr., 1907, ii, 945), is applied to the data obtained by Stas in ascertaining the ratio between (*a*) potassium chloride and potassium nitrate, and (*b*) sodium chloride and sodium nitrate. The first paper deals with the first of these ratios, and in it the following corrected atomic weights are deduced: potassium, 38·9985; chlorine, 35·4941; oxygen, 16·013, and nitrogen, 14·0043.

The second paper deals with the second ratio, and in it the following corrected atomic weights are arrived at: sodium, 22·9965; chlorine, 35·4889; oxygen, 16·0229; nitrogen, 14·0076. T. A. H.

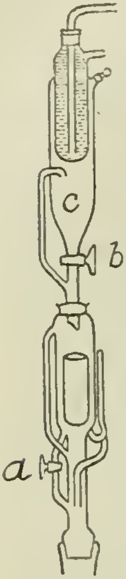
Permeability of Glass for Gas. ALFRED STOCK and HANS HEYNEMANN (*Ber.*, 1909, 42, 1800—1801. Compare Zengelis, this vol., ii, 134).—A piece of silver foil was placed in a small glass flask, which was completely evacuated and sealed. It was placed inside a larger vessel containing iodine, which was likewise closed. After three months there was not the slightest indication of any iodine having passed through the glass. This is contrary to the observations of Zengelis (this vol., ii, 134), whose results are explained as being due to his having sealed his vessels with paraffin. E. F. A.

A Useful Oil-bath. LOUIS W. BOSART, jun. (*J. Amer. Chem. Soc.*, 1909, 31, 724).—A mixture of 10 parts of refined cotton-seed oil and one part of beeswax makes a very satisfactory oil-bath. It emits very little fume below 250°, and can be safely used almost throughout the range of the ordinary mercury thermometer, having a flash point above 300° when heated in an open cup. The mixture is solid at the ordinary temperature; it melts quickly, and can be used almost immediately after heat is applied. T. S. P.

Extraction Apparatus for Plant Products. SAMUEL J. M. AULD and SAMUEL S. PICKLES (*Chem. News*, 1909, 99, 242).—The apparatus described and figured consists of an arrangement of two flasks so connected that the boiling saturated solution is syphoned into a second flask placed at a lower level, from which it is simultaneously distilled back again into the first flask. The extract thus accumulates in the lower flask, while the distilled solvent extracts still further the substance placed in the first flask. With this apparatus large quantities of material can be readily and rapidly dealt with. J. V. E.

New Condenser for Extraction Apparatus. Carlo Fraschina (*Chem. Zentr.*, 1909, i, 1633; from *Giorn. Farm. Chim.*, 1909, 58, 111—112).—The apparatus described (annexed figure) is arranged for use with a Soxhlet extraction apparatus, and is so constructed that when the extraction is complete, by opening tap *a* and closing tap *b*, the solvent may be collected in reservoir *c*.

J. V. E.



[Lecture Experiments.] Quantitative Volumetric Gas Analysis and Synthesis. P. Rischbieth (*Chem. Zentr.*, 1909, i, 1224; from *Zeitsch. phys. chem. Unter.*, 1909, 22, 19—29).—A number of quantitative experiments are described which are easily and rapidly carried out with a modified form of Bunte's gas burette, namely, the synthesis of water, analysis of atmospheric air, of marsh gas, ethylene, and acetylene, the volumetric analysis of nitric oxide, the oxidation of nitric oxide by oxygen, and the volumetric analysis of nitrous oxide.

J. V. E.

Lecture Experiments. [Oxides of Copper.] Willem P. Jorissen and H. Filippo, jun. (*Chem. Weekblad*, 1909, 6, 377—380).—Two lecture experiments are described. One illustrates the formation of cuprous oxide when copper is heated in a limited supply of air; there is, in the paper, a sketch of the apparatus employed. The other demonstrates the partial decomposition of cupric oxide, with evolution of oxygen, at a high temperature.

A. J. W.

Inorganic Chemistry.

Apparatus for the Purification of Gaseous Hydrogen by means of Liquid Hydrogen. H. Kamerlingh Onnes (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 11, 883—886).—An apparatus for the purification of hydrogen by liquefaction and subsequent evaporation is described. When impure commercial hydrogen is employed, a preliminary purification is effected by freezing out the admixed gases.

H. M. D.

The Precipitation of Metals from Aqueous Solutions of their Salts by Hydrogen at High Temperatures and Pressures. Wladimir N. Ipatieff and W. Werchowsky (*Ber.*, 1909, 42, 2078—2088).—Experiments on the reduction of dissolved salts to the metallic state by hydrogen under pressure have given negative results in many cases (compare Nernst and Tammann, Abstr., 1892, 561). By employing the apparatus used for organic reductions under high pressure (Abstr., 1908, i, 330), pressures up to 600 atm. may be obtained. Under 200 atm., silver and mercury are precipitated even from $N/10$ solution at the ordinary temperature. Copper is not precipitated even under 500 atm.

At 60—70° cupric salts deposit cuprous oxide in the form of carmine-red crystals, above 90° the product is a mixture of cuprous oxide and copper, and above 120° it consists of pure copper in branched crystals. A pressure of 100 atm. is sufficient, but precipitation does not occur under atmospheric pressure.

Nickel, cobalt, lead, and bismuth are similarly precipitated at a high temperature. Nickel is completely precipitated at 200° under 180 atm.

Iron salts have been examined at 350° under 230 atm. Ferric acetate then deposits the whole of its iron as anhydrous red ferric oxide, soluble in hydrochloric acid. At 400° under 420 atm. a small quantity of metallic iron was also found, but each experiment only lasted a few minutes, owing to the bursting of the steel tubes.

If Nernst's hypothesis is accepted, the electrolytic solution tension must be regarded as a variable, depending on the pressure, temperature, and ionic concentration. It is suggested that hydrolysis first takes place, the metallic hydroxide being then reduced to metal by the hydrogen. Against this, however, is the fact that the addition of sulphuric acid to copper sulphate, although reducing the hydrolysis, does not hinder precipitation. Preliminary experiments also indicate that oxides or hydroxides under a layer of water are only reduced with difficulty by hydrogen. C. H. D.

Composition of Atmospheric Air. Georges Claude (*Compt. rend.*, 1909, **148**, 1454—1456).—The continuous apparatus described previously for separating nitrogen and oxygen from air (Abstr., 1906, ii, 16) and obtaining a residue of the rare gases has been subjected to a prolonged test, which shows that the separation of neon, helium, and hydrogen is of a sufficiently quantitative nature to lead to an estimate of these gases in air. The mixture of gases obtained was passed over magnesium to remove traces of nitrogen, and then over cupric oxide to remove hydrogen, which was weighed as water. The residual mixture of neon and helium had an extremely constant density, 0·53 to 0·57 (air = 1), corresponding with a ratio of neon to helium of 412 : 143. The proportion of the gases obtained from air was also fairly constant, 360 cubic metres of air yielding 7·25 litres. The proportion of hydrogen in air was found to vary considerably, the purest air obtainable containing less than one part in a million. The variation was found to be largely due to a leaky gas producer in the same building as the air compressor. With a view to showing the delicacy of the apparatus and method, one millionth of its volume of hydrogen was added to 180 cubic metres of air, and the mixture passed through the machine. About half the hydrogen was recovered as water (69 milligrams) in thirty minutes.

One million volumes of air contain 15 volumes of neon, 5 volumes of helium, and less than 1 volume of hydrogen. R. J. C.

Method for the Preparation of Colloidal Sulphur. Alfred Himmelbauer (*Zeitsch. Chem. Ind. Kolloide*, 1909, 4, 307—308).—If pieces of gelatin or agar-agar are placed in a solution of ammonium polysulphide, they begin to opalesce at the end of a few hours, and finally become white and non-transparent. A similar effect is obtained with a solution of hydrogen sulphide. In the separation of the colloidal sulphur from the aqueous solutions, the gelatin and agar-agar appear to act as catalysts and accelerate the process. H. M. D.

Action of Pyrosulphuryl Chloride, $S_2O_5Cl_2$, on Sulphur, Selenium, and Tellurium. Wilhelm Prandtl and Paul Borinski (*Zeitsch. anorg. Chem.*, 1909, 62, 237—249. Compare this vol., ii, 310).—Pyrosulphuryl chloride is without action on sulphur in the cold; on warming, sulphur chloride distils. The oxytetrachloride, $S_2O_3Cl_4$, if formed, decomposes at once.

When selenium is heated with excess of pyrosulphuryl chloride at 120—140° until dissolved, and the excess of solvent driven off under reduced pressure, white crystals of sulphur selenium oxytetrachloride, SO_3SeCl_4, m. p. 165°, b. p. 185°, are obtained. Constitutional formulæ have been assigned to this compound by Rose (*Ann. Phys. Chem.*, 1838, [i], 44, 315) and Clausnizer (Abstr., 1879, 201), but the authors regard it as an additive compound analogous to such double halides as $SeCl_4,PCl_5$. In confirmation of this, it is found that selenium tetrachloride reacts with an excess of sulphur trioxide to form the *compound*, $2SeCl_4,3SO_3$, white crystals, m. p. 145°. When heated above its melting point, this substance loses sulphur trioxide and yields the compound $SeCl_4,SO_3$, identical with that described above. Ammonia forms selenium nitride, SeN.

Selenium tetrabromide and sulphur trioxide yield bright yellow needles of a *compound*, $SeBr_4,2SO_3$, which sinters without melting, and at 170° forms the yellow *compound*, $SeOBr_2,SO_3$.

Tellurium and pyrosulphuryl chloride form the *compound*, $TeCl_4,SO_3$, which crystallises in glistening cubes, or, if allowed to separate slowly, in crystals up to 1 cm. in length, which change into a second modification. It melts at 180° without decomposition. Dry ammonia forms a complex product containing tellurium nitride.

Tellurium tetrachloride and sulphur trioxide form white crystals of a *compound*, $TeCl_4,2SO_3$, m. p. 85°, which decompose at 120°, yielding the compound described above.

Tellurium tetrabromide and sulphur trioxide form a yellowish brown, crystalline *compound*, $TeOBr_2,2SO_3$.

Sulphuryl chloride is without action on selenium or tellurium in the cold; the tetrachlorides are formed on heating; chlorosulphonic acid forms coloured, unstable solutions containing the compounds $SeSO_3$ and $TeSO_3$. C. H. D.

Caro's Acid. Richard Willstätter and Emil Hauenstein (*Ber.*, 1909, 42, 1839—1850).—The methods hitherto adopted have been insufficient to decide between the two formulæ for Caro's acid, H_2SO_5 (Baeyer and Villiger, Abstr., 1901, ii, 380) and $H_2S_2O_9$ (Armstrong and Lowry, Abstr., 1902, ii, 558). The analysis of salts is inconclusive, since a salt, $MHSO_5$, is indistinguishable from $M_2S_2O_9,H_2O$.

The acyl derivatives, however, are monobasic acids, and behave as mixed peroxides of persulphuric acid and acyl peroxides, confirming the formula H_2SO_5 for Caro's acid. The benzoyl derivative is thus decomposed by alkalis into Caro's salt and benzoate: $COPh\cdot O\cdot O\cdot SO_3H + H_2O = OH\cdot O\cdot SO_3H + Ph\cdot CO_2H$, and by acids into sulphuric acid and benzoyl hydrogen peroxide: $COPh\cdot O\cdot O\cdot SO_3H + H_2O = H\cdot O\cdot O\cdot COPh + H_2SO_4$.

Caro's reagent is better prepared from sodium or ammonium persulphate than from the less soluble potassium salt; it crystallises in hard prisms.

In the analysis of Caro's reagent, the three estimations, of hydrogen peroxide, sulphonyl hydrogen peroxide, and persulphuric acid, may be carried out with one solution. Twenty-five c.c. of a solution containing 40 grams of Mohr's salt and 150 c.c. of sulphuric acid per litre, standardised with permanganate, are diluted with 300 c.c. of water and cooled to 0°. The Caro's solution is diluted ten times, and 10—20 c.c. added to the mixture of titrating solution and ice. After stirring, the solution is at once titrated with permanganate. This gives the Caro's acid; reduction of the warm solution gives the Caro's acid + persulphuric acid.

Caro's reagent decomposes rapidly when alkali carbonate or a small quantity of alkali hydroxide is added. It is much more stable in presence of a large excess of alkali hydroxide.

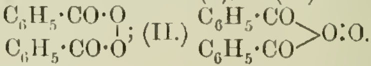
Caro's acid may be prepared from hydrogen peroxide. On adding ammonium sulphate–hydrogen peroxide (Abstr., 1903, ii, 537) to concentrated sulphuric acid at $-10°$, and adding ice after all has become liquid, the product is found to consist of Caro's acid with a little persulphuric acid.

Benzoyl chloride reacts with neutral Caro's reagent at 0°, and crystals of the sparingly soluble *potassium benzoylperoxysulphonate*, $C_6H_5\cdot CO\cdot O\cdot O\cdot SO_3K,H_2O$, separate. The salt is neutral, and may be recrystallised from water below 50°. The water of crystallisation is lost in a vacuum over sulphuric acid. The salt may also be obtained anhydrous by crystallisation from alcohol. The active oxygen is estimated by titration with iodine.

The anhydrous salt explodes on rubbing, and the hydrated on contact with sulphuric acid or on warming to 70—80°. Ferrous sulphate gives a violet coloration even in $N/2000$ solution; ferric chloride gives the same coloration on heating. The acid is stable in acid solution, but is hydrolysed by alkalis to Caro's salt and benzoate. The hydrolysis to sulphuric acid and benzoyl hydrogen peroxide is accomplished by the action of ethereal sulphuric acid.

A dilute solution of Caro's acid reacts with benzenesulphonyl chloride at 8—12°, but not at lower temperatures, to form *potassium benzenesulphonylperoxysulphonate*, $C_6H_5\cdot SO_2\cdot O\cdot O\cdot SO_3K$, which crystallises from water below 40° in glistening prisms, and explodes on rubbing or warming.

In order to show that derivatives of hydrogen peroxide arise from $H\cdot O\cdot O\cdot H$, and not from $\underset{O}{\overset{H\cdot O\cdot H,}{\vdots}}$ ethyl peroxide and benzoyl peroxide have been reduced with platinum and hydrogen in the cold. Ethyl alcohol was obtained in the first, and benzoic acid in the second, case. Benzoyl peroxide must thus have the formula (I), as (II) would give rise to benzoic anhydride: (I.)



$$\text{(I.)}\ \begin{matrix}C_6H_5\cdot CO\cdot O\\ \vert\\ C_6H_5\cdot CO\cdot O\end{matrix}\ ;\quad \text{(II.)}\ \begin{matrix}C_6H_5\cdot CO\\ C_6H_5\cdot CO\end{matrix}\!\!>\!O{:}O.$$

C. H. D.

Molecular Weight of Selenium.

F. OLIVARI (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 465—468).—A reply to Paternò's criticism (this vol., ii, 118) of the author's work on this subject (this vol., ii, 39).

T. H. P.

Selenium and Iodine.

GIOVANNI PELLINI (*Atti. R. Accad. Lincei*, 1909, [v], 18, i, 463—465).—A reply to the criticisms of Paternò (this vol., ii, 118) on the work of Pellini and Pedrina (Abstr., 1908, ii, 833).

T. H. P.

Nitrosyl Perchlorate, the Anhydride of Nitrous and Perchloric Acids.

KARL A. HOFMANN and (GRAF) ARMIN ZEDTWITZ (*Ber.*, 1909, 42, 2031—2034).—When mixed oxides of nitrogen, prepared from sodium nitrite and 68% nitric acid, are passed into concentrated perchloric acid (a mixture of dihydrate and monohydrate), colourless, doubly refracting leaflets separate; when these are drained and dried over phosphoric oxide in an atmosphere of nitrogen oxides, and finally in a vacuum, a 20—30% yield of *nitrosyl perchlorate*, $NO\cdot O\cdot ClO_3,H_2O$, is obtained. By evaporating the mother liquor at 140°, and again passing nitrogen oxides, a further yield is obtained. For analysis, the nitrogen is estimated in the nitrometer, the substance being soluble in concentrated sulphuric acid without evolution of gas. The perchloric acid is estimated by saturating with alkali, igniting, and estimating the chloride, the hydrogen by passing the vapour over lead peroxide and a copper spiral, and the nitrous acid by titration with permanganate.

Nitrosyl perchlorate only absorbs moisture from the air very slowly. A little water decomposes it, forming a green solution. Methyl alcohol forms methyl nitrite, and ethyl alcohol, acetone, or ether ignite with explosion. Violent explosions occur with primary aromatic amines, probably owing to the formation of diazonium perchlorates. Phenols give the colorations of the Liebermann reaction. C. H. D.

Revision of the Atomic Weight of Phosphorus; Density of Hydrogen Phosphide.

G. TER GAZARIAN (*Compt. rend.*, 1909, 148, 1397—1399).—Hydrogen phosphide was prepared by the action of water on calcium phosphide, and was purified by repeated liquefaction and fractional distillation. The density was determined by direct weighing, and was found to be 1·1829 compared with air. One litre of the gas under normal conditions weighs 1·5293 grams. After correcting for deviations from the gas laws, the molecular weight of hydrogen phosphide is found to be 33·930, which is accurate to one part in 3000, and hence the atomic weight of phosphorus is 30·906, or in round numbers, 30·91. T. S. P.

The Compounds of Sulphur and Phosphorus. IV. The Existence of Phosphorus Disulphide, P_3S_6. ALFRED STOCK [with H. VON BEZOLD, B. HERSÇOVICI, and M. RUDOLPH] (*Ber.*, 1909, 42, 2062—2075).—The literature of the phosphorus sulphides is reviewed. Mixtures of the two phosphorus sulphides, P_4S_3 and P_2S_5, in different proportions have been examined in sealed, exhausted glass tubes. Three temperatures have been determined for each mixture, that at which the substance becomes moist, that at which sintering takes place, and the melting point. The melting-point curve has only a single maximum at 310°, corresponding with the formula P_4S_7, and eutectic points at 47·5% S and 127° and 69% S and 248° respectively. The sintering-point curve (this vol., ii, 543) also clearly indicates the compound P_4S_7, and there is no indication of P_3S_6.

The same results are obtained whether mixtures of the sulphides or mixtures of sulphur and phosphorus are used for the experiments, provided that the mixtures are heated to 300° in an atmosphere of carbon dioxide to ensure combination. Giran's results (Abstr., 1906, ii, 226) are explained by imperfect equilibrium, his mixtures only having been heated to 200°.

The sulphide P_4S_7 may be purified by repeated recrystallisation from carbon disulphide, or by careful fractional distillation. It is also obtained when a solution of P_4S_3 and P_2S_5 in carbon disulphide is heated above 100°.

There is no evidence of the existence of a phosphorus disulphide, PS_2 or P_3S_6. All the substances previously described as such are mixtures of P_4S_3 and P_2S_6. C. H. D.

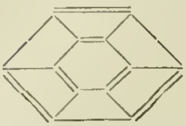
Compounds of Boron with Certain Metals. ARMAND BINET DU JASSONNEIX (*Ann. Chim. Phys.*, 1909, [viii], 17, 145—216).—A résumé of work already published (compare Abstr., 1907, ii, 30, 95, 691, 692, 779). G. S.

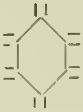
The Coking Test. O. BINDER (*Zeitsch. anal. Chem.*, 1909, 48, 372—375).—The well-known method of estimating the amount of coke yielded by heating a known weight of coal in a covered platinum crucible until no more gases are evolved has been applied by the author to some other substances having the same elementary composition (gum, starch, cellulose, and dextrin), and, no doubt, owing to a different structure, the amount of coke yielded is very different. Gum gave 17·73% (ash-free) of coke; starch, 9·9%; cellulose, 6·71% (according to Muck), whilst dextrin gave only 4·40%. The coke from gum is very solid, that of starch loose and covered with soot, and that of dextrin very porous, hollow, and lustrous.

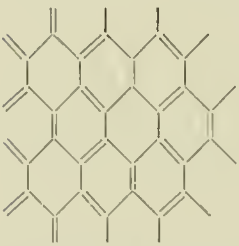
Sucrose yielded 7·79%; lactose, 5·71%, and catechol, 36·55%, of coke. Sucrose-coke is lustrous, highly fused, and hollow, that of lactose, also fused and brown, with a tinge of blue. The coke from catechol is very similar to that yielded by soft coals.

A number of illustrations are given, showing the characteristic appearance of the various cokes. L. DE K.

Constitution of Wood Charcoal. Ossian Aschan (*Chem. Zeit.*, 1909, 33, 561).—The annexed representation of the molecule of wood charcoal as two concentric benzene nuclei (Dewar, *Chem. News*, 1908, 97, 16) does not harmonise with the tension theory, for whilst wood charcoal is an exceedingly stable substance, the strain in such a molecule must be greater even than that in a molecule of an explosive substance, such as acetylene.



The representation of the molecule of wood charcoal must, according to the author's views, explain its great stability, its intense colour, the formation of mellitic acid by oxidation, and the presence of a small quantity of hydrogen, oxygen, and possibly nitrogen. These two (or three) elements are probably essential constituents of wood charcoal, which may be possibly a highly carbonaceous organic substance. The analysis of wood charcoal prepared above 1500° gives numbers almost identical with those required by the formula $(C_{130}H_{10})_x$ or $(C_{132}H_{10}O)_x$. The author suggests that an unstrained arrangement of benzene nuclei, such as that figured, satisfies these requirements. The colour may be attributed to the group , and the addition of hydrogen and oxygen may take place at the outermost carbon atoms; moreover, the web-like structure may account for the great absorptive power of charcoal, whilst its property of retaining dyes and other coloured substances may be due to the formation of loose additive compounds with the serried benzene nuclei. Bone charcoal contains about 1% of nitrogen, and Stollé has observed that the proportion of carbon to nitrogen is about 10 : 1. This fact is brought into agreement with the preceding representation by assuming that one or more of the bounding CH groups is replaced by N.



C. S.

Liberation of Helium from Radioactive Minerals by Grinding. J. A. Gray (*Proc. Roy. Soc.*, 1909, 82, *A*, 301—306).—The author has determined the amount of helium which is liberated when thorianite is reduced by grinding to a more or less finely divided state. After grinding in an agate mortar, the mineral was shaken up with water, and, after the particles had been allowed to settle out for a definite time, the upper part of the water was syphoned off. The mineral suspended in this was left to settle out, and a weighed portion of the dry substance was then heated with nitric acid in an exhausted tube, the helium being afterwards pumped off and its volume determined. From a microscopic examination of the different samples of mineral, an estimate of the size of the particles was obtained.

In general, the amount of helium liberated increases with the fineness of the particles. When the diameter of the particles exceeds 10μ, very little helium is liberated. On the other hand, a temporary limit to the amount of helium liberated is reached when the mineral is reduced to particles of a diameter of about 3μ. This limit corresponds with the liberation of about 28% of the contained helium. The conclusion is drawn that part at least of the helium in thorianite is retained in a structure which is very large compared with the molecular structure. H. M. D.

Molecular and Some Other Constants of the Inactive Gases. George Rudorf (*Phil. Mag.*, 1909, [vi], 17, 795—813 *).—The velocities, mean free paths, and diameters of the molecules of the inert gases have been calculated. The molecular velocities calculated from the mean kinetic energy are respectively: helium 13·11, neon 5·845, argon 4·13, krypton 2·86, and xenon $2{\cdot}28 \times 10^4$ cm. per second. The mean free paths are for helium, 2·85, and for argon, $1{\cdot}006 \times 10^{-5}$ cm.

The calculation of the molecular diameters was made by three different methods, involving respectively the mean free path, the number of molecules in unit volume of gas, and the viscosity coefficient. In the case of the first two methods, the required value of the volume occupied by the molecules themselves in unit gas volume was obtained in four different ways: (*a*) from the density of the liquid (as an upper limit), (*b*) from the coefficient *b* of van der Waals' equation, (*c*) from the dielectric constant, and (*d*) from the refraction. The separate values thus obtained for the molecular diameters vary very considerably, and indicate that even in the case of the simple monatomic gases, the kinetic theory is far from satisfactory. In the case of helium, for example, the numbers vary from 0·426 to $28{\cdot}5 \times 10^{-5}$ cm.

The number of molecules contained in unit volume of helium and argon has also been calculated in different ways, and in this case, also, the numbers show considerable discrepancy.

By making use of the formula of Lorentz and Lorenz, the following values were obtained for the refractive index of the inactive elements in the form of liquid: helium 1·03, argon 1·23, krypton 1·26, and xenon 1·46. These numbers are for infinitely long waves. In the absence of a value for the density of liquid neon, its refractive index could not be calculated, but it is shown that this density is probably 1·24.

Attention is directed to an error in the estimation of the molecular mean free paths and diameters of certain gases by Lord Kelvin (Abstr., 1902, ii, 649). H. M. D.

The Occurrence of Ammonia and Nitrate in Deposits of Potash Salts. Wilhelm Biltz and E. Marcus (*Zeitsch. anorg. Chem.*, 1909, 62, 183—202).—Small quantities of ammonium salts have been previously detected in salt deposits, but nitrates and nitrites have not been observed.

Systematic profiles have been taken through the Stassfurt and the Vienenburg deposits. The ammonia was estimated colorimetrically with Nessler's solution, special precautions having to be taken on account of its small quantity. Potassium was estimated as perchlorate, and chlorine by titration.

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* and *Ann. Physik.*, 1909, [iv], 29, 751—779.

The Stassfurt results show that the quantity of ammonia follows that of the carnallite, being practically zero in the rock-salt and anhydrite regions. It is independent of the total potassium. The distribution of bromine in the deposits is very similar (Boeke, Abstr., 1908, ii, 505), and it is probable that the two substances are present entirely as ammonium carnallite and bromo-carnallite respectively. The Vienenburg deposits give similar results. The younger carnallites are less rich in ammonia than the older. A sea-water obtained from these salts would contain 0·056 mg. NH_3 per litre, whilst a modern sea-water contains 0·2 mg. These figures confirm Erdmann's view *Zeitsch. angew. Chem.*, 1908, 21, 1685), that these salt deposits were not formed by the direct evaporation of sea-water.

Nitrites were not detected in any of the deposits. Nitrates were only found in the salt clays, which are also the only strata of the series in which organic remains are found. C. H. D.

Formation of Potassium Nitrate from Sodium Nitrate and Potassium Carbonate from the Standpoint of the Phase Rule. Robert Kremann and A. Žitek (*Monatsh.*, 1909, 30, 311—340).—The system represented by the equation $2NaNO_3 + K_2CO_3 \rightleftharpoons Na_2CO_3 + 2KNO_3$ has been investigated, solubility determinations having been made at 10° and 24·2°. Complete diagrams are given.

The mutual solubilities of the four salt pairs were determined with the following results: (1) Sodium nitrate and potassium nitrate do not form a double salt, although the solubility of each is increased by the addition of the other. (2) Sodium carbonate and potassium carbonate form the double salt, $Na_2CO_3,K_2CO_3,6H_2O$. (3) At 24·2° the addition of sodium nitrate to solutions saturated with respect to sodium carbonate changes the solid phase from $Na_2CO_3,10H_2O$ to $Na_2CO_3,7H_2O$ at a definite concentration. At 10° the solid phase under such conditions is always $Na_2CO_3,10H_2O$, there being no transition point. (4) With the exception of the case just mentioned the relations at 10° are similar to those at 24·2°.

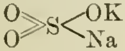
The solubility relations of the single salts showed that the systems containing three solid phases were the following: potassium nitrate–sodium carbonate–sodium nitrate; potassium nitrate–sodium carbonate–double salt; potassium nitrate–double salt–potassium carbonate. The compositions of the solutions corresponding with these three systems were determined, and the results present the following points of interest: (1) In solutions saturated with respect to sodium carbonate and potassium nitrate, which also contain sodium nitrate, the carbonate is present as Na_2CO_3,H_2O in the solid phase at 24·2°; at 10° it is $Na_2CO_3,10H_2O$. (2) When potassium nitrate is added to the solution saturated with respect to sodium carbonate and double salt, the latter is almost completely precipitated.

In the last part of the paper the results obtained are applied to show how potassium nitrate and sodium carbonate can be technically prepared from sodium nitrate and potassium carbonate. Experiments on a small scale gave very satisfactory results. T. S. P.

Existence of Isomeric Double Sulphites of Potassium and Sodium. Alexander E. Arbusoff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 447—451).—The double sulphites obtained by neutralising (1) potassium hydrogen sulphite by means of sodium carbonate, and (2) sodium hydrogen sulphite by means of potassium carbonate, give with methyl iodide at the ordinary temperature the same compound,

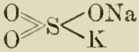
$$Me{\cdot}SO_3K,$$

the methyl group replacing the sodium atom in each case. If, therefore, two isomeric double sulphites having the constitutions



$$\begin{matrix}O\\O\end{matrix}{>}S{<}\begin{matrix}OK\\Na\end{matrix}$$

and



$$\begin{matrix}O\\O\end{matrix}{>}S{<}\begin{matrix}ONa\\K\end{matrix}$$

are capable of existing, the form in which the potassium atom is united with sulphur is unstable, and changes readily into the other isomeride (compare Godby, Proc., 1907, 23, 241).

T. H. P.

Solubility of Disodium Hydrogen Phosphate in Water. Tsutomu Shiomi (*Mem. Col. Sci. Eng. Kyōto*, 1908, i, 406—413).—The solubility of disodium hydrogen phosphate in water has been determined by a direct method at a number of temperatures between 0° and 100°. Some of the results, in grams of anhydrous salt in 100 grams of water, are as follows: 3·55 at 10·26°; 12·02 at 25·15°; 54·88 at 40·29°; 83·00 at 60·23°; 102·15 at 99·77°. There are three breaks in the curve, at 36·45°, 48°, and 95·2°. The first corresponds with the transition from dodecahydrate to heptahydrate, and the second and third probably represent the transitions from heptahydrate to dihydrate and dihydrate to anhydrous salt respectively. The investigation of the latter points is, however, not complete.

G. S.

Sub-oxides of Cæsium. Étienne Rengade (*Compt. rend.*, 1909, 148, 1199—1202).—When an alkali metal is burned in an insufficient supply of air (or oxygen), it is difficult to tell by ordinary methods whether the substance produced is a definite sub-oxide or a mixture of metal and protoxide. The author has made use of the fact that the protoxides of the alkali metals dissolve in the metals themselves, and in the case of cæsium the fusion curves of the system cæsium–cæsium monoxide have been studied. The curves show the existence of four oxides other than the protoxide, namely: Cs_7O, Cs_4O, Cs_7O_2, and Cs_3O. Only Cs_7O gives a maximum in the curve, the other three oxides transforming one into the other, and finally into Cs_2O as the percentage of oxygen increases. Besides the stable eutectics consisting of $Cs-Cs_7O$ and Cs_7O-Cs_4O, there is a metastable eutectic consisting of $Cs_7O-Cs_7O_2$. Pure crystals of the oxide Cs_7O_2 have been obtained; they resemble those of potassium permanganate both in shape and colour. The sub-oxides of cæsium, which have thus been proved to exist, do not possess formulæ in accordance with the univalent character of the alkali metals.

T. S. P.

Rubidium Peroxide Hydrate and Rubidium Percarbonate. ERICH PELTNER (*Ber.*, 1909, 42, 1777—1782).—*Rubidium peroxide hydrate*, $RbO\cdot OH,H_2O_2$, is obtained as an oily precipitate which, on cooling, solidifies to a mass of white crystals, on mixing molecular proportions of rubidium hydroxide and of 30% hydrogen peroxide, both dissolved in alcohol; the substance is a snow-white, deliquescent solid, which is fairly stable below 0°, and when freshly prepared dissolves in water without decomposition; at the ordinary temperature, however, it undergoes violent decomposition, and evolves oxygen with a considerable rise of temperature. After the reaction has subsided, a hard, yellow solid remains, which dissolves in water with evolution of oxygen. From a determination of the available oxygen in this substance it appears to be a hydrated form of the oxide, Rb_2O_4.

Rubidium percarbonates of the composition $Rb_2CO_4,2H_2O_2,H_2O$, $Rb_2CO_4,H_2O_2,2H_2O$, and $Rb_2CO_4,2\frac{1}{2}H_2O$ are obtained by dissolving one molecular proportion of rubidium carbonate in one, two, or three molecular proportions of 30% hydrogen peroxide solution, and sufficient water to obtain a clear solution; on adding alcohol to the cooled solution these substances are precipitated in the form of white, crystalline solids; they are all very hygroscopic, and evolve oxygen on being dried in a vacuum, but if kept dry they do not turn yellow. The dried substances evolve more oxygen on moistening with water.

P. H.

Conditions of Solubility of Silver Iodide in Sodium Iodide Solutions. W. S. KRYM (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 382—385).—The author has determined the solubility of silver iodide in sodium iodide solutions of various concentrations. The curve giving mols. of sodium iodide as abscissæ and mols. of silver iodide as ordinates for the temperature 25° consists of three branches, the corresponding solid phases being silver iodide, double salt, $AgI,NaI,3{\cdot}5H_2O$, and sodium iodide respectively. The solubility of silver iodide increases continuously when the solid phase is silver iodide, and decreases continuously when this phase is double salt or sodium iodide.

T. H. P.

Hydrates of the Halogen Salts of Calcium. P. I. KUSNETZOFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 367—379).—The author's results confirm the existence of two forms of tetrahydrated calcium chloride, one stable (α-form) and the other unstable (β-form).

The following hydrates have also been prepared: $CaBr_2,4H_2O$, with transition temperature about +55°; $CaI_2,4H_2O$, with transition temperature about +65°; $CaI_2,7H_2O$, decomposing between +1° and −2°.

T. H. P.

Red Lead. JAROSLAV MILBAUER (*Chem. Zeit.*, 1909, 33, 513—514, 522—523).—The temperature at which red lead is technically produced being uncertain, the author has experimentally studied the temperature limits of its formation and the reversibility of the reaction. A special form of gas furnace is described, capable of maintaining a temperature constant within ±2°, the gas supply being regulated by an electro-magnetic regulator, actuated by the pressure of carbon dioxide contained in a spiral tube of silvered copper placed in the furnace. The temperature was measured by means of a thermocouple.

The substance was contained in a horizontal tube of Jena glass, one end of which was carried by a slowly rotating spindle, the other being conically ground and fitted into the conical end of the gas delivery tube, the joint being lubricated with gold-leaf, thus maintaining a gas-tight joint during rotation. The air or oxygen supplied was heated before entering by passing through a tube containing porcelain and copper oxide in the upper part of the furnace, and was passed through at constant velocity by means of a special gasometer (Abstr., 1907, ii, 252).

The lead oxide used was prepared by twice precipitating from purified lead nitrate and drying in a vacuum at 130° until free from water. The red lead formed was estimated by titration (Topf, Abstr., 1887, 997).

The formation of red lead proceeds faster at first, then more slowly, approaching a state of equilibrium. The velocity of the air or oxygen is without influence, provided that sufficient oxygen is present. Measurable oxidation occurs even at 240°, the yield increasing up to 450°, and altering little beyond that. A fuller study of the influence of temperature is in progress. Below 450° the product is always brown, true red lead only being obtained from 450° upwards (compare Liebig, *Zeitsch. angew. Chem.*, 1904, 11, 167).

The yield increases exponentially with the partial pressure of the oxygen, and is practically independent of the amount of moisture present in the gas. C. H. D.

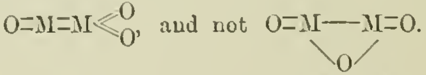
Solubility of Lead Sulphate. J. Sehnal (*Compt. rend.*, 1909, **148**, 1394—1396).—Owing to the discrepancies in the literature, the author has redetermined the solubility of lead sulphate in water. At the ordinary temperature, forty-eight hours are necessary for saturation to be attained. 0·0824 Gram of lead sulphate dissolves in 1000 c.c. of water, or 1 part in 12,135 parts of water; moreover, the solubility is the same at 100° as at the ordinary temperature (18°). The discrepancies in the results of previous observers are ascribed to impurities in the lead sulphate, it being shown that a trace of sulphuric acid has a considerable effect on the solubility.

The fact that lead sulphate dissolves in water is ascribed to hydrolysis, and in support of this it is shown that the solubility of hydrated oxide of lead (PbO,H_2O) in dilute sulphuric acid is the same as the solubility of lead sulphate in water. T. S. P.

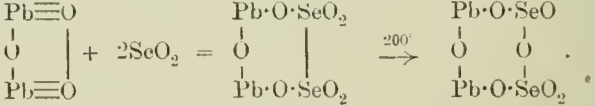
A New Type of Sesquioxides. Selenite of Lead Sesquioxide and Thallic Selenite. Luigi Marino (*Zeitsch. anorg. Chem.*, 1909, **62**, 173—182).—Lead sesquioxide, prepared either by the action of sodium hypochlorite on an ice-cooled solution of sodium plumbite, or by decomposing the selenite, $Pb_2Se_2O_7$, with sodium hydroxide, reacts with a warm concentrated solution of selenious acid, forming $Pb_2Se_2O_7$. After the reaction is over, the whole is heated to boiling, filtered, digested with cold 7% nitric acid, and washed. The product is identical with that formerly described (Abstr., 1908, ii, 833). Only traces of selenate are formed, showing that there is not an intermediate production of lead dioxide.

A selenite of this type differs from those obtained from other sesquioxides, such as those of iron, aluminium, or yttrium, in not forming acid or basic salts under any conditions. Thallium behaves like lead, the sesquioxide reacting with selenious acid to form a white, crystalline selenite, $Tl_2(SeO_3)_3$. Experiments with tin are difficult to perform, owing to the difficulty of preparing a pure tin sesquioxide.

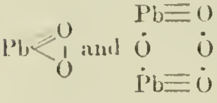
When a sesquioxide reacts with sulphurous acid to form a dithionate, its constitution is most probably:



Lead sesquioxide, on the other hand, probably has the constitution indicated by its reaction with selenious acid:



This leads to the assumption that lead dioxide can exist in single and in double molecules (I and II). The double molecules exist at low temperatures and high concentration, reacting with selenious acid to form $Pb_2Se_2O_7$, whilst in dilute solution the single molecules react, forming the ordinary selenite, $PbSeO_3$.



(I.) (II.)

The constitution of lead metaplumbate is also discussed.

C. H. D.

Dyeing Properties of Lead Chromate. Léo Vignon (*Compt. rend.*, 1909, 148, 1329—1331; *Bull. Soc. chim.*, 1909, [iv], 5, 675—678).—Fabrics are usually dyed with lead chromate by passing the material through the aqueous solution of a soluble lead salt and then through a solution of potassium or sodium chromate. The author finds that dyeing also occurs if the material is agitated in a suspension of precipitated lead chromate in water; equally good results are obtained with silk, wool, or cotton. The lead chromate does not combine chemically with the material dyed.

Dyeing also takes place if the lead chromate is suspended in alcohol or benzene, but the resulting colours are not so deep as those obtained when water is the medium of suspension.

T. S. P.

Some New Compounds and Double Compounds of Tervalent Thallium. Julius Gewecke (*Annalen*, 1909, 366, 217—236).—An investigation on the preparation and properties of several halogen derivatives of tervalent thallium. It is shown that the supposed thallic fluoride of Willm (*Ann. Chim. Phys.*, 1865, [iv], 5, 5) is in reality thallic oxyfluoride, TlOF. Attempts to prepare thallic fluoride were unsuccessful, owing to the great tendency of this substance to hydrolyse; further, the only double salt of thallic fluoride which could be isolated was the potassium salt, $2TlF_3,KF$, which is likewise unstable, being decomposed by atmospheric moisture with evolution of hydrogen fluoride.

The following salts of the types $2TlCl_3,M''Cl_2,6H_2O$ and $2TlCl_3,M''Cl_2,8H_2O$, analogous to the corresponding gold double salts, were obtained by allowing a solution of the components in water acidified with hydrochloric acid to evaporate in a vacuum over sulphuric acid. *Thallic nickel chloride* ($8H_2O$), bright green crystals. *Thallic cobalt chloride* ($8H_2O$), hygroscopic, red crystals. *Thallic calcium chloride* ($6H_2O$), large, colourless, transparent crystals. *Thallic strontium chloride* ($6H_2O$) was also prepared; the corresponding *barium* salt could not be obtained in a pure state. *Thallic magnesium chloride* ($6H_2O$), large, transparent, colourless crystals. *Thallic zinc chloride* ($6H_2O$), colourless prisms.

Thallic manganese chloride ($6H_2O$), long, silky, pale pink needles, and *thallic copper chloride* ($6H_2O$), large, pale blue crystals, are obtained only from neutral aqueous solutions.

Thallic oxyfluoride, $TlOF$, obtained by the action of dilute hydrofluoric acid on thallic hydroxide at the ordinary temperature, is a dark olive-green powder.

Potassium thallic fluoride, $2TlF_3,KF$, is prepared by fusing potassium hydrogen fluoride with thallic fluoride and treating the product with anhydrous hydrofluoric acid; it is obtained as a white mass.

Thallic fluorochloride, $TlFCl_2,3H_2O$, prepared by passing chlorine into a solution of thallous fluoride in 40% hydrofluoric acid, crystallises in colourless needles. It yields the *anhydrous* salt, a white, crystalline powder, when kept in a vacuum over phosphoric oxide. *Thallic fluorochloride potassium chloride*, $2TlFCl_2,KCl$, forms colourless crystals. The anhydrous fluorochloride combines with ammonia, forming the *salt*, $TlFCl_2,4NH_3$, a white substance, and with pyridine, forming the *salt*, $TlFCl_2,2C_5H_5N$, crystallising in slender, white needles. *Thallic fluorobromide*, $TlFBr_2$, a pale yellow, crystalline substance, is more stable than the analogous chloride; *thallic fluorobromide ammonia*,

$$TlFBr_2,4NH_3,$$

is a yellowish-white powder. W. H. G.

Theory of the Fusion of Copper in Cupola Furnaces. N. Juschkevitsch (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 469—472).—The author has studied the reactions occurring in an atmosphere of dry nitrogen in an electric furnace between the following pairs of compounds, finely powdered and well mixed, taken in the proportions indicated.

(1) $Cu_2O + FeS$.—These substances begin to react according to the equation: $Cu_2O + FeS = Cu_2S + FeO$ at 280—285°, the velocity of the reaction increasing as the temperature is raised. At 700°, after two hours' heating, it was found that 95·65% of the sulphur had passed from the iron to the copper.

(2) $2CuO + FeS$.—Evolution of sulphur dioxide in this reaction is

very slow, a large proportion of the sulphur remaining in the mixture passing from the iron to the copper.

(3) $Cu_2S + Fe$.—The formation of ferrous sulphide when this mixture is heated at 600° is very slight, only 5% of the sulphur passing from the copper to the iron after six hours' heating.

(4) $2Cu + FeS$.—The reaction $2Cu + FeS = Cu_2S + Fe$ proceeds considerably more slowly than the change: $Cu_2O + FeS = Cu_2S + FeO$, six hours' heating at 600° only resulting in 26·1% of the sulphur passing from the iron to the copper.

By fusing CuO and FeS in presence of silica, coarse metals were obtained containing (1) 74·7% Cu, 3·45% Fe, and 20·75% S; and (2), 72·64% Cu, 4·48% Fe, and 21·28% S. T. H. P.

Influence of Small Quantities of Arsenic and Antimony on Copper. ARTHUR H. HIORNS and S. LAMB (*J. Soc. Chem. Ind.*, 1909, **28**, 451—457).—Alloys were prepared by melting a rich copper-arsenic alloy with copper. The electrical conductivity falls rapidly with the increase of arsenic. Alloys containing up to 2·5% As are quite ductile, and can be rolled cold. Copper-antimony alloys are less malleable.

Both series of alloys are found to consist of solid solutions, which only attain equilibrium after prolonged heating. Traces of a blue arsenide, probably Cu_3As, appear above 0·21% As. The compound Cu_3Sb also appears in small quantity on slow cooling. C. H. D.

Reduction of Copper Sulphate with Hydroxylamine. MAXWELL ADAMS and ELIZA OVERMAN (*J. Amer. Chem. Soc.*, 1909, **31**, 637—640).—When solutions of hydroxylamine and anhydrous copper sulphate in methyl alcohol are mixed at −10°, pale green crystals of the compound $CuSO_4,NH_2{\cdot}OH$ are formed if the copper sulphate is in excess, whereas deep green crystals having the composition $CuSO_4,2NH_2{\cdot}OH$ are obtained when the hydroxylamine is in excess. These salts are stable when dry, but are changed into cuprous oxide when warmed with water to which a drop of alkali has been added; when left in contact with excess of hydroxylamine in methyl alcoholic solution, they become violet in colour, hydroxylamine being absorbed. By treating a saturated solution of copper sulphate in methyl alcohol with a large excess of pure hydroxylamine, violet crystals were obtained, which could not be dried without partial decomposition. Analysis indicated the formula: $CuSO_4,5NH_2{\cdot}OH$.

A cold aqueous solution of hydroxylamine acts on the compound $CuSO_4,2NH_2{\cdot}OH$ with the formation of a bright green, non-crystalline compound, $Cu_2OSO_4,2NH_2{\cdot}OH$; this compound also results from the interaction of cupric hydroxide and a solution of hydroxylamine sulphate.

All the above compounds, with the exception of the one containing $5NH_2{\cdot}OH$, are stable in alcohol or ether, or water at zero. In water, decomposition begins at 15°, and proceeds rapidly with rise in temperature; a drop of alkali solution changes them into cuprous oxide.

When a salt of hydroxylamine is added to a solution of copper sulphate, the further addition of sodium hydroxide is supposed to give rise to the following compounds in succession: $CuSO_4,NH_2{\cdot}OH$, $CuSO_4,2NH_2{\cdot}OH$, $CuSO_4,5NH_2{\cdot}OH$, $Cu_2OSO_4,2NH_2{\cdot}OH$. The last compound is then decomposed by the alkali with evolution of nitrogen and formation of cuprous oxide; in the presence of excess of hydroxylamine the cuprous oxide is reduced to copper. T. S. P.

Cuprous Sulphate. ALBERT RECOURA (*Compt. rend.*, 1909, **148**, 1105—1108).—Cuprous sulphate is not known in the free state, although the compounds $Cu_2SO_4(CO)_2,H_2O$ and $Cu_2SO_4,4NH_3$ have been described. The author shows that by operating in absence of water, methyl sulphate and cuprous oxide may be made to yield cuprous sulphate, Cu_2SO_4: $Cu_2O + Me_2SO_4 \longrightarrow Cu_2SO_4 + OMe_2$. Ethyl sulphate will react in the same way, the corresponding ether being evolved. The reaction is carried out by heating 2 grams of powdered cuprous oxide with 20 c.c. of methyl sulphate at 160° until methyl ether ceases to be evolved (about a quarter of an hour). The cuprous sulphate is obtained as a greyish-white powder, which is washed with ether, carefully excluding air, and finally dried in a vacuum. When dry, cuprous sulphate is stable in dry air, but is immediately decomposed by water with development of heat:

$Cu_2SO_4(\text{solid}) + Aq = CuSO_4(\text{dissolved}) + Cu(\text{precipitate}) + 21$ cals.

The development of heat in this decomposition is contrary to the behaviour of other cuprous salts, and explains why cuprous sulphate cannot be prepared in aqueous solution. Freshly prepared cuprous sulphate if allowed to oxidise before drying is converted into a soot-black powder, from which cupric sulphate is dissolved by water, leaving an oxide with all the properties of Rose's oxide, Cu_4O. Dry Cu_2SO_4, oxidised at 200°, yields the basic salt, $CuO,CuSO_4$.

Cuprous sulphate is soluble in concentrated hydrochloric acid, in ammonia, and in glacial acetic acid, the last giving an intensely violet solution. R. J. C.

Copper Complexes in Ammoniacal Solution. ARTHUR HANTZSCH and PHILIP WILFRED ROBERTSON (*Ber.*, 1909, **42**, 2135—2137. Compare this vol., ii, 44).—Polemical. A reply to Dawson (this vol., ii, 316). W. H. G.

Action between Metals and Acids and the Conditions under which Mercury Causes Evolution of Hydrogen. SAMUEL W. J. SMITH (*Phil. Mag.*, 1909, [vi], **17**, 833—848).—Pure mercury displaces hydrogen from solutions of hydrochloric and sulphuric acid in the same way as the more strongly electropositive metals. The reaction ceases before a perceptible quantity of hydrogen has been evolved, because of the inhibiting influence of a very small quantity of mercury salt. An arrangement is described by means of which the reaction is made continuous. In this, mercury is allowed to escape from a containing tube in the form of a very fine jet, which impinges on the solution of acid. When this jet of mercury is in direct communication with a mercury surface at rest in the same solution, the concentration

of the mercury salt at this surface is prevented from becoming or remaining large enough to stop the evolution of hydrogen, and this is evolved continuously. The amount of mercury salt which is sufficient to stop the action at the still surface diminishes with the concentration of the acid solution, and, as a consequence, it is impossible to decompose the acid by means of the action of the jet when the concentration of the acids fall below a certain limit. For both hydrochloric and sulphuric acid, the limiting concentration was found to be about 6 gram-equivalents per litre. In addition to the simple displacement of hydrogen, secondary effects resulting in the production of hydrogen sulphide and free sulphur have also been observed in the action of pure mercury on sulphuric acid solutions. These correspond with the equations: $4Hg_2 + 5H_2SO_4 = 4Hg_2SO_4 + H_2S + 4H_2O$ and $3Hg_2 + 4H_2SO_4 = 3Hg_2SO_4 + S + 4H_2O$ respectively.
H. M. D.

New Process for the Preparation of Aluminium Nitride. ATH. J. SOFIANOPOULOS (*Bull. Soc. chim.*, 1909, [iv], 5, 614—616).—Aluminium powder, contained in a porcelain tube, is heated to a temperature somewhat below its melting point, and then subjected to the action of a stream of dry ammonia, until the latter passes over unchanged. The resulting *nitride*, Al_2N_2, is an amorphous, grey, spongy product, which is quite stable when dry, and decomposes water slowly at the ordinary temperature and rapidly at 100°, yielding ammonia and aluminium hydroxide. The nitride is not affected by oxygen even when warmed in an atmosphere of this gas, but is readily attacked by halogens, yielding nitrogen and the corresponding salt of aluminium. With solutions of alkali hydroxides, it yields ammonia and alkali aluminates. The nitride can also be prepared by using the vapour of hydrazine or azoimide in place of ammonia.
T. A. H.

The Weathering of Clays. II. JAKOB M. VAN BEMMELEN (*Zeitsch. anorg. Chem.*, 1909, 62, 221—236. Compare Abstr., 1905, ii, 89).—The white efflorescence on the surface of many volcanic clays in Java consists mainly of silica (diatoms), and not of calcium sulphate. Extraction with sodium hydroxide and hydrochloric acid of different strengths shows that the volcanic clay of Pasoeroean contains silica (as diatoms and as opal), a readily decomposable silicate, $Al_2O_3,3SiO_2$, and a stable silicate, kaolinite, $Al_2O_3,2SiO_2$. The latter compound occurs in larger quantity in the loess and alluvial clays. Clays of the laterite type contain silicates in which the ratio of silica to alumina falls below 2. The kaolinite is probably microcrystalline, the lower silicates representing a further stage in the weathering.

It is impossible to determine how much of the ferric oxide, magnesia, lime, and alkalis is present as microcrystalline silicates, and how much as adsorption compounds of the hydrogels of silica, alumina, and ferric oxide. Crystalline pseudomorphs are certainly present.
C. H. D.

Labile Forms of Tetrahydrated Manganese Bromide and Chloride. P. I. KUSNETZOFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 353—367).—Tetrahydrated manganese bromide exists in two forms:

(1) the ordinary stable α-modification, which has a pale red colour and crystallises in large, monoclinic prisms, six-sided plates, or drusy or rosette-like masses, and (2) the less stable β-form, which separates in thin, almost colourless plates. As is the case with other unstable forms (compare Lehmann, *Molekularphysik*, I, 194), the β-tetrahydrate exhibits a lower decomposition temperature and a greater solubility than the α-form. The β-modification changes into the red form at 57—58°.

Two similar modifications of the tetrahydrate of manganese chloride have been prepared. T. H. P.

Nature of the Cast Irons. George B. Upton (*J. Physical Chem.*, 1909, **13**, 388—416).—The properties of iron carbon alloys are examined from the point of view of a modified Roozeboom diagram which the author has given in a previous paper (Abstr., 1908, ii, 1042). It is shown that this is in much better agreement with observed facts than the metastable equilibrium diagrams which have been put forward by various observers.

In regard to the metallographic nature of the cast irons, the author arrives at the conclusion that grey cast iron contains crystalline graphite mechanically mixed with a metallic matrix, which is a solution of silicon and carbon in γ-iron. White cast iron is a supersaturated solution of carbon and silicon in γ-iron. Malleable cast iron contains temper graphite mechanically mixed with a metallic matrix, which is α-iron, ferrite, and a larger or smaller quantity of pearlite.

H. M. D.

Iron Sulphide. III. Hans Malfatti (*Zeitsch. anal. Chem.*, 1909, **48**, 352—356. Compare Abstr., 1908, ii, 192).—Double compounds are described containing iron, sulphur, and potassium or calcium, formed by precipitating ferric chloride with excess of potassium or calcium sulphide. Ammonium sulphide also yields a precipitate containing ammonium.

These precipitates, which may be considered as thioferrites, are not very stable, and suffer decomposition to a large extent when treated with water. L. de K.

The Fusion of Ferric Oxide. Ernst J. Kohlmeyer (*Metallurgie*, 1909, **6**, 323—325).—Ferric oxide may be melted by introducing it into a platinum crucible previously heated to 1600°. The platinum crucible is enclosed in an outer crucible of spinel ($2MgO,Al_2O_3$) and heated by a granular carbon resistance. A current of oxygen is led through the furnace during the operation. After heating to 1600°, the crucible is allowed to cool, and a cooling curve taken. The freezing point of ferric oxide is found to be 1562—1565°. On cooling, there is a slight development of heat at 1350—1250°, and a more marked one at about 1030°. In spite of the presence of an atmosphere of oxygen, some loss of oxygen takes place, but this does not largely affect the freezing point. Pure ferrosoferric oxide, Fe_3O_4, freezes at 1527°.

Ferric oxide crystallises in tabular, rhombohedral scales with steely lustre. The edges are transparent, and ruby-red in colour; D 5·187—5·193. C. H. D.

Artificial Preparation of Rinneite on the Basis of its Solubility Diagram. H. E. Boeke (*Sitzungsber. K. Akad. Berlin.*, 1909, 24, 632—638. Compare this vol., ii, 153).—The relationship between rinneite ($FeCl_2,3KCl,NaCl$) and its component salts has been investigated.

According to dilatometric observations, $FeCl_2,4H_2O$ is transformed into $FeCl_2,2H_2O$ at 72·6°. The double salt, $FeCl_2,2KCl,2H_2O$ (douglasite), is formed from $FeCl_2,4H_2O$ and KCl at 38·3°; it is stable up to 85°. $FeCl_2,4H_2O$ and NaCl do not yield a double salt, but in presence of sodium chloride the temperature at which $FeCl_2,4H_2O$ is transformed into $FeCl_2,2H_2O$ is lowered to 69·6°.

Observations with a dilatometer containing a mixture of the composition $3KCl,1NaCl,1FeCl_2,4H_2O$ showed that rinneite is formed from its components at 26·4°. Solubility data obtained at 38° are recorded, and from these a diagram showing the relationships between rinneite and its components has been constructed. For the artificial preparation of the triple salt, a solution, obtained by dissolving 5·96 grams of sodium chloride, 20·9 grams of potassium chloride, and 123·4 grams of ferrous chloride ($FeCl_2,4H_2O$) in 55·4 grams of water, should be isothermally evaporated at 38° with the addition of a crystal of rinneite. H. M. D.

The Hydrosol of Chromium Oxide. H. W. Woudstra (*Chem. Weekblad*, 1909, 6, 375—377 *).—The author has prepared a hydrosol of chromium oxide by precipitating the nitrate with potassium hydroxide, dissolving the precipitated oxide in acetic acid, evaporating to dryness, and dialysing. The colloidal solution is reddish-brown by transmitted light, and green by reflected light. It is quite different from that described by Biltz (Abstr., 1903, ii, 153). A. J. W.

Chromyl Subchloride. P. Pascal (*Compt. rend.*, 1909, 148, 1463—1465).—When pure dry nitric oxide is passed into chromyl chloride, which is kept cool in a bath of water, nitrosyl chloride and a new chromyl subchloride are produced:

$$5CrO_2Cl_2 + 4NO \dashrightarrow (CrO_2)_5Cl_6 + 4NOCl.$$

The liquid chromyl chloride is transformed with development of heat into a crystalline paste, which, when the remaining chromyl chloride is removed in a vacuum at 100°, yields chromyl subchloride as a brown, crystalline powder of density 2·51. Carbon monoxide aided by sunlight can effect the same reduction as nitric oxide.

Chromyl subchloride, unlike chromyl chloride, is strongly magnetic, so that the functions of chromium in chromyl, CrO'_2, and in the compound radicle, $(CrO_2)'_5$, appear to be different. In fact, chlorine, which only acts above 150°, converts the subchloride back to chromyl chloride but very slowly.

Chromyl subchloride is deliquescent, and readily dissolves in water to a dark brown solution with an odour of chlorine and the reactions of chromium salts, chromic acid, and hydrochloric acid. If slowly heated to 150°, chromyl chloride is evolved, and if quickly heated, chlorine only, the solid product in both cases being Thorpe's chloride, $(CrO_2)_3Cl_2$. Above 180° oxygen is evolved, leaving an insoluble brownish-black residue of $Cr_6O_9Cl_4$. Towards hydrogen, hydrogen sulphide, etc., chromyl subchloride acts as a chlorinating agent at low temperatures, whilst above 200° its action is generally an oxidising as well as chlorinating one. Moist gaseous ammonia acts very violently, the products being ammonium chloride, oxygen, and the oxides CrO_2 and Cr_2O_3. Generally speaking, however, chromyl subchloride is less reactive than chromyl chloride.

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* and *Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 33.

When chromyl subchloride is suspended in dry ether, and a current of slightly moist ammonia is passed through, nitrogen is evolved, and ammonium chloride and a brown, amorphous precipitate remain. Ammonium chromate and chromium chromate are removed from the precipitate by washing, and the pale brown, insoluble residue when dried at 90° has the composition $(CrO_2)_5(NH_4O)_6$. This compound is explosive. R. J. C.

Complex Tungstates: Borotungstates and Metatungstates. Hippolyte Copaux (*Ann. Chim. Phys.*, 1909, [viii], **17**, 217—267).—A résumé of work already published (compare this vol., ii, 148, 318). G. S.

Oxides of Uranium. William Oechsner de Coninck (*Compt. rend.*, 1909, **148**, 1462).—Uranic sulphate solution, when treated with an equivalent of barium nitrate, filtered, and evaporated almost to dryness on the water-bath, yields a mixture of the hydroxide, $UO_3,2H_2O$ (pale yellow) with a little UO_3,H_2O (orange-yellow), but not uranic nitrate. The two hydrates can be separated by hand. A mixture of uranous and uranic sulphates similarly treated gives a mixture of hydroxides, $UO_3,2H_2O$ and UO_2,H_2O (reddish-brown). The latter is in a form spontaneously oxidisable by air to the orange-yellow hydroxide, UO_3,H_2O. R. J. C.

Anhydrous Compounds of Thorium Chloride with Alkali Chlorides. Eduard Chauvenet (*Compt. rend.*, 1909, **148**, 1267—1270).—Although hydrated compounds of thorium chloride ($ThCl_4$) with potassium, ammonium, and cæsium chlorides are known, they invariably yield oxychlorides on attempting to remove the water by heat. The author prepares amorphous anhydrous double chlorides by fusing anhydrous thorium chloride and alkali chloride together in the exact proportions. The heat of solution of the mass in water, where differing from the total heat of solution of its constituents, is held to indicate the formation of a compound. The following were prepared: $ThCl_4,2LiCl$ (heat of formation, 4·67 Cal.); $ThCl_4,2NaCl$ (4·3 Cal.); $ThCl_4,2KCl$ (9·14 Cal.); $ThCl_4,2RbCl$ (19·3 Cal.); $ThCl_4,2CsCl$ (14·9 Cal.); $ThCl_4,4RbCl$ (26·3 Cal.); $ThCl_4,4CsCl$ (18·11 Cal.); $ThCl_4,NH_4Cl$ (13·12 Cal.). These appear to be all the possible anhydrous compounds of thorium chloride with alkali chlorides.

The compound $ThCl_4,NH_4Cl$ is not prepared by fusion as the others are, but by heating the hydrate $ThCl_4,2NH_4Cl,10H_2O$ at 150°, when water and ammonium chloride are given off. At 500° the remaining molecule of ammonium chloride is also lost; thus it is possible to dehydrate thorium chloride, like magnesium chloride, through the intermediation of its ammonium chloride compound.

R. J. C.

Hydrated Compounds of Thorium Chloride with Alkali Chlorides. Eduard Chauvenet (*Compt. rend.*, 1909, 148, 1519—1522. Compare preceding abstract).—The following compounds have been prepared by evaporating solutions of thorium chloride with three equivalents of alkali chloride: $ThCl_4,LiCl,8H_2O$; $ThCl_4,NaCl,10H_2O$; $ThCl_4,KCl,9H_2O$; $ThCl_4,2RbCl,9H_2O$;
$ThCl_4,2CsCl,8H_2O$;
$ThCl_4,2NH_4Cl,10H_2O$. Since the anhydrous compounds of Li, Rb, and Cs are known, it is possible to determine the heats of addition of each molecule of solid water to the hydrate. These are 3·27, 1·55, and 2·30 Cal. respectively. The heat of hydration in the case of KCl and NaCl compounds is estimated from thermal data for the known compounds $ThCl_4,2NaCl$ and $ThCl_4,2KCl$ to be of the same order as that of the lithium compound.

On heating these hydrates in a current of dry hydrogen chloride at 150°, the rubidium and cæsium compounds with low heats of hydration are dehydrated, whereas the lithium, sodium, and potassium compounds are converted into anhydrous oxychlorides of the type $ThOCl_3,MCl$.

$ThCl_4,LiCl,8H_2O$ at 200° gives $ThOCl_3,LiCl$, which at 400° yields $ThOCl_2,LiCl$. At 800° thorium tetrachloride and lithium chloride volatilise, leaving a residue of thorium dioxide.

The metallic thorium of Berzelius and Nilson was doubtless contaminated with thorium oxide, as it was prepared from the chloride, $ThCl_4,KCl,9H_2O$. The same applies to the metallic thorium of Moissan, as the mixture he employed ($ThCl_4$, MCl, and M) is hygroscopic. It should, however, be possible to prepare pure thorium from its double chloride with rubidium or cæsium. R. J. C.

Fusibility of Mixtures of Gold and Tellurium. Henri Pélabon (*Compt. rend.*, 1909, 148, 1176—1177).—On heating a mixture of gold and tellurium in a vacuous sealed tube, the gold readily dissolves in the tellurium as soon as the melting point of the latter element has been attained. If the proportion of gold is more than 60%, it is necessary to raise the temperature above the melting point of tellurium in order to dissolve the metal, and the mixtures become more and more pasty as the percentage of gold increases.

The fusion curve of such mixtures consists of a rectilinear portion extending from the melting point of tellurium (452°) to the eutectic temperature, 415° (16·5% Au). It then rises to a maximum at 472°, corresponding with 41—45% Au, namely, with the compound Au_2Te_4, which occurs naturally as calaverite. Mixtures containing more than 56% Au always show only one arrest at 452°, the melting point of tellurium; they are pasty masses, which solidify to heterogeneous solids in which gold and tellurium can be readily distinguished. The fusion curve gives no evidence of the existence of a compound Au_2Te. T. S. P.

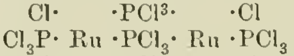
Melting Point of Platinum. Charles W. Waidner and George H. Burgess (*Compt. rend.*, 1909, 148, 1177—1179).—The authors (Abstr., 1907, ii, 882) have previously found temperatures varying from 1706° to 1753° for the melting point of platinum, and Féry and Chéneveau (Abstr., 1909, ii, 321) have attributed the discrepancies to the influence of the gaseous atmosphere in which the platinum was melted, since they found that the temperature, as measured by the optical pyrometer, varied as much as 30° to 50°, according as the metal was melted in the electric furnace or by means of a flame. The authors do not agree with this explanation, and incline to the view that the discrepancies are due to the fact that the constant C_2 in Wien's equation : $I = C_1\lambda^{-5}e^{-C_2/\lambda\theta}$ is not known with sufficient accuracy. They also point out that, although the empirical equation : $E = -a + bt + ct^2$, which is used to calibrate a platinum platinum-iridium thermocouple, holds between 300° and 1100°, there is no proof that it holds up to 1800°, that is, for an extrapolation of 700°. T. S. P.

Atomic Weight of Palladium. Part II. The Analysis of Palladosammine Bromide. ALEXANDER GUTBIER, P. HAAS, and H. GEBHARDT (*J. pr. Chem.*, 1909, [ii], 79, 457—474).—Pure palladium was dissolved in a mixture of hydrobromic and nitric acids. The latter acid was expelled by repeated evaporation with hydrobromic acid, the residue dissolved in a small quantity of hydrobromic acid, and filtered into excess of ammonium hydroxide. A brown precipitate of the salt $Pd(NH_3)_4Br_2,PdBr_2$ was produced, but on prolonged digestion with ammonium hydroxide it dissolved, with the formation of palladosammine bromide, $Pd(NH_3)_2Br_2$. The solution was filtered into excess of hydrobromic acid, whereby the palladosammine bromide was obtained as a yellow, finely crystalline precipitate. The precipitate was washed free from ammonium bromide, again dissolved in ammonium hydroxide, and precipitated with hydrobromic acid, the process being repeated three times. The pure bromide thus obtained was dried at 105—110° to constant weight.

The percentage of palladium in the salt was determined by reducing it with hydrogen, and heating the hydrogenised metal so obtained to a temperature of 150° in a current of dry carbon dioxide in order to obtain the pure metal (this vol., ii, 407). Two different sets of experiments were carried out, the materials used in each set being of different origin. As a result of the first set of nine experiments it was found that 18·76375 grams of palladosammine bromide contained 6·65983 grams of palladium ; in the second set of nine experiments, 21·56275 grams of palladosammine bromide gave 7·65308 grams of palladium. The mean result of these experiments gives 106·689 as the atomic weight of palladium, whereas the atomic weight deduced from experiments on palladosammine chloride (Abstr., 1909, ii, 407), after being corrected for the alteration of the atomic weight of chlorine from 35·45 to 35·46, gave the number 106·655. T. S. P.

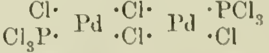
The Action of Phosphorus Haloids on Platinum Metals. WILHELM STRECKER and M. SCHURIGIN (*Ber.*, 1909, 42, 1767—1776).—Geisenheimer (*Ann. Chim. Phys.*, 1891, [vi], 23, 231) states that phosphorus pentachloride has practically no action on metallic iridium, but the present authors find that when spongy iridium is heated with phosphorus pentachloride for five to six hours at 300—350° an unstable compound is produced, which cannot be isolated, and also a second compound, which is best obtained by adding some phosphorus trichloride to the reaction product and heating for five hours more at 250°. This substance, *triphosphorus trichloride iridochloride*, $IrCl_3,3PCl_3$, crystallises from chloroform in aggregates of white needles, and decomposes without melting at 230°. Using phosphorus pentabromide and tribromide in place of the corresponding chloro-derivatives, the authors obtained *triphosphorus tribromide iridobromide*, $IrBr_3,3PBr_3$, in the form of stable, ruby-red crystals; a substance of the same composition prepared by Geisenheimer (Abstr., 1891, 1383) is described by him as forming unstable, reddish-brown crystals which fume in the air.

Using ruthenium sponge in place of iridium, *tetrachlorodiruthenium pentaphosphorus trichloride*, $Ru_2Cl_{19}P_5$, was obtained, which separates from chloroform in dark reddish-yellow crystals. The composition of this substance may be expressed in accordance with Werner's theory by the annexed formula.



$$\begin{array}{ccccc} Cl\cdot & & \cdot PCl^3\cdot & & \cdot Cl \\ Cl_3P\cdot & Ru & \cdot PCl_3\cdot & Ru & \cdot PCl_3 \\ Cl\cdot & & \cdot PCl_3\cdot & & \cdot Cl \end{array}$$

The corresponding *tetrabromodiruthenium pentaphosphorus tribromide*, $Ru_2Br_{19}P_5$, was also prepared, but could not be obtained quite free from metal, owing to its insolubility. The phosphorus trichloride palladochloride, previously described by Fink (Abstr., 1892, 1285) as having the formula $PdCl_2,PCl_3$, is shown by a molecular-weight determination in chloroform solution to have the double formula $(PdCl_2,PCl_3)_2$, and its constitution may, therefore, be expressed as follows:



$$\begin{array}{ccccc} Cl\cdot & & \cdot Cl\cdot & & \cdot PCl_3 \\ Cl_3P\cdot & Pd & \cdot Cl\cdot & Pd & \cdot Cl \end{array}$$

The corresponding *phosphorus tribromide palladobromide*, $(PdBr_2,PBr_3)_2$, forms reddish-brown, deliquescent crystals. No analogous compounds could be obtained from the metals rhodium and osmium. P. H.

Mineralogical Chemistry.

Optical Activity of Mineral Oils in an Optically Transparent State. MICHAEL A. RAKUSIN (*Ber.*, 1909, 42, 1640—1647. Compare Abstr., 1904, i, 641).—The majority of mineral oils when distilled yield dextrorotatory derivatives, a few give inactive distillates, and two from Java and Borneo give feebly lævorotatory distillates. The question arises whether the crude oils themselves possess activity, and if so, what is the magnitude and sense. The author finds that crude mineral oils from Binagady and Bibi-Eybat, after being clarified by fuller's earth, are dextrorotatory, and the rotation increases with the density.

Mineral oils do not racemise when distilled, and the active constituents are concentrated in the less volatile fractions. The sign of the rotation is unchanged by distillation. C. S.

Optical Investigation of Bibi-Eybat Naphtha. MICHAEL A. RAKUSIN (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 483—500. Compare Abstr., 1907, ii, 883; 1908, ii, 115).—The percentage yields obtained within similar limits of temperature during the fractional distillation of corresponding naphthas are inversely proportional to the densities and, consequently, also to the depths of the layers.

Natural naphthas are dextrorotatory, the amount of the rotation increasing with the density, and hence with the depth of the layer.

The questions of racemisation, carbonisation, and influence of high temperatures on the decomposition of naphtha are discussed, together with the influence of the earth's magnetism on the rotation of natural naphtha and the content of paraffins in a naphtha as a criterion of its geological age. T. H. P.

Composition of Bauxite. H. ARSANDAUX (*Compt. rend.*, 1909, **148**, 1115—1118. Compare this vol., ii, 490).—The author has made complete analyses of sixteen French bauxites containing different proportions of silica in order to determine the nature of the silicate in them. Bauxite is mainly insoluble in concentrated hydrochloric acid, but all the iron and a variable proportion of the alumina are dissolved. Traces of titanium and silica are also found in the solution. The insoluble portion consists mainly of alumina, water, silica, and titanium oxide. If the silica which cannot be boiled out with sodium carbonate solution is supposed to be all combined in the form of kaolinite ($H_4Al_2Si_2O_9$), the remaining water is slightly in excess of the ratio $H_2O:(Al_2O_3+TiO_2)$. In two samples, however, the ratio is nearer $2H_2O:Al_2O_3$. It is supposed that in presence of silica, alumina may form a higher hydrate than Al_2O_3,H_2O. R. J. C.

Constitution and Genesis of Natural Ferric Sulphates. VII. Ihleite, Janosite, Copiapite. RUDOLF SCHARIZER (*Zeitsch. Kryst. Min.*, 1909, **46**, 427—453. Compare Abstr., 1907, ii, 482).—The mineral janosite ($Fe_2(SO_4)_3,9H_2O$), recently described by H. Böckh and K. Emszt (Abstr., 1905, ii, 536) has been asserted by E. Weinschenk and by Z. Toborffy (Abstr., 1907, ii, 629) to be identical with copiapite. The present author had previously suggested (Abstr., 1907, ii, 482) that material having this composition consists of a mixture of copiapite ($Fe_4S_5O_{21},18H_2O$) and ferric tetrasulphate ($Fe_2S_4O_{15},9H_2O$), and new experiments support this conclusion. It also appears that a compound having the composition given for ihleite has no existence.

Ordinary copiapite ($Fe_4S_5O_{21},18H_2O$ or $[HO]_2Fe_4[SO_4]_5,17H_2O$) is called *a*-copiapite to distinguish it from a similar substance with the composition $(HO)Fe_3(SO_4)_4,13H_2O$; the latter is called β-copiapite, and is probably identical with Rammelsberg's misy. The various ferric sulphates are differently soluble in alcohol, and they can be purified with the help of this. Experiments with acetone suggest that even concentrated solutions are hydrolytically dissociated into various components. L. J. S.

Adamite from Monte Valerio, Tuscany. PIERO ALOISI (*Zeitsch. Kryst. Min.*, 1909, **46**, 478—479; from *Proc. verb. Soc. Toscana Sci. Nat.*, 1907, **17**, 4—9).—Cavities in a specimen of zinciferous limonite contained brilliant sulphur-yellow crystals of adamite. These are orthorhombic, with $a : b : c = 0.9736 : 1 : 0.7013$. The following analysis closely agrees with the usual formula, $Zn(ZnOH)AsO_4$.

As_2O_5.	ZnO.	Fe.	H_2O.
40·75	55·79	trace	[3·46]

L. J. S.

Does Thorium Exist as Thorium Silicate in Monazite?

O. Kress and Floyd J. Metzger (*J. Amer. Chem. Soc.*, 1909, 31, 640—652).—Some authorities state that thorium is present in monazite as a silicate, either as orangite or thorite, whilst others claim that it is present as a phosphate, either replacing a part of the cerium earths or being present as a normal phosphate; still others claim that it is present both as phosphate and silicate.

The authors have analysed a number of different specimens of monazite, determining in each case the percentages of thoria, total silica, quartz, and of silicate silica. In no case was silica absent; the percentage generally increased with an increase in thoria content, but it did not do so invariably. Out of fifty analyses in which the silicate silica was separately determined, forty-five showed insufficient silica to combine with the thorium to form thorium silicate. Thirty-nine analyses showed insufficient total silica to combine with the thorium found. Out of a total of sixty-four analyses, fifty-five indicate that the thorium is not present as a silicate.

A microscopic examination was also made of monazite, and, for the sake of comparison, of thorite. The optical characteristics of the silicate present in monazite were quite different from those of thorite, and indicated that the silicate is probably a felspar.

The microscopic and chemical investigations thus both lead to the same conclusion, namely, that thorium is not present in monazite in the form of thorium silicate. T. S. P.

Calcium in Potash-felspar, and the Formation of Myrmekite.

Arthur Schwantke (*Centr. Min.*, 1909, 311—316).—The small amount of calcium (1—2% CaO) frequently present in orthoclase has usually been assumed to be due to the isomorphous intermixture of the anorthite molecule, $CaAl_2Si_2O_8$, with the orthoclase molecule, $K_2Al_2Si_6O_{16}$. Some of the published analyses agree with this supposition, whilst others are better explained by the assumption that the hypothetical molecule, $CaAl_2Si_6O_{16}$, is present. The existence of such a molecule receives some support from the stilbite formula:

$$(Ca,Na_2)Al_2Si_6O_{16},6H_2O.$$

Again, the existence of the intimate intergrowth of plagioclase and quartz, known as myrmekite (which has probably been derived from the alteration of orthoclase), suggests that there may have been a change from $CaAl_2Si_6O_{16}$ to $CaAl_2Si_2O_8$ with a separation of free silica. L. J. S.

[A Mineral Associated with Turquoise in New Mexico.]

E. R. Zalinski (*Zeitsch. Kryst. Min.*, 1909, 46, 388; from *Economic Geol.*, 1907, 2, 464—492).—An account is given of the occurrence of turquoise in the Burro Mountains, New Mexico. It occurs in decomposed granite, and is associated with kaolinite, quartz, halloysite, and a pale greenish-yellow mineral of doubtful nature. The following analysis, by K. Adams, indicates that the last is related to halloysite.

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	P_2O_5.	TiO_2.	Cu.	Total.
42·59	19·70	2·46	0·06	0·63	2·71	0·53	0·20	25·36	0·89	0·11	3·89	99·13

L. J. S.

Constitution of Zeolites. ENNIO BASCHIERI (*Zeitsch. Kryst. Min.*, 1909, **46**, 479—480; from *Proc. verb. Soc. Toscana Sci. Nat.*, 1907, **16**, 34—42).—Tschermak's method (Abstr., 1907, ii, 771) of isolating silicic acids is extended. Natrolite (the so-called savite) from Montecatini, Tuscany, gave a silica jelly, the composition of which at the first alteration point is SiO_2 62·32, H_2O 37·68, corresponding with orthosilicic acid. Natrolite is therefore considered to be an orthosilicate with water of constitution, the formula being $H_4Na_2Al_2(SiO_4)_3$.

Laumontite ("caporcianite") from the same locality has the following composition, agreeing with the formula, $CaAl_2Si_4O_{14},4H_2O$, of fresh laumontite (and thus disproving the idea that caporcianite is a partly dehydrated laumontite).

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
50·10	21·50	12·02	1·17	0·20	15·06	100·05

The silica jelly obtained from this mineral is also orthosilicic acid, and the formula of laumontite is therefore written as $H_8CaAl_2(SiO_4)_4$.

L. J. S.

Constitution of Ilvaite. ENNIO BASCHIERI (*Zeitsch. Kryst. Min.*, 1909, **46**, 480; from *Proc. verb. Soc. Toscana Sci. Nat.*, 1907, **16**, 49—52).—Ilvaite from Elba was also examined by Tschermak's method. The silicic acid obtained contained 30·67 H_2O, corresponding with diorthosilicic acid, $H_6Si_2O_7$. The formula of ilvaite is therefore written as $[FeO]_2Fe_2[FeOH]_2[Si_2O_7]_2$. L. J. S.

A Nephelinic Syenite with Sodalite from the Transvaal. H. A. BROUWER (*Compt. rend.*, 1909, **148**, 1274—1277).—The mineral contains:

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	H_2O	Cl_2.	Total.
48·35	0·45	23·10	2·48	2·51	0·89	13·20	3·58	2·91	1·49	100·85

In the cooling of the rock, syenite appears to have separated first, followed by ægyrine, felspar, and nepheline. The rock is very similar mineralogically and chemically to one from Greenland and one from Tavajokthal described by Rosenbusch and Ramsay respectively.

R. J. C.

[Garnet from Idaho.] JAMES FURMAN KEMP and C. G. GUNTHER (*Zeitsch. Kryst. Min.*, 1909, **46**, 389; from *Trans. Amer. Inst. Min. Engin.*, 1907, **38**, 269—296).—A garnet-rock occurs in association with copper ores at the contact of limestone with quartz-porphyry near Mackay in Idaho. Analysis I is of pale amber-yellow material, and II, of massive garnet:

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	H_2O.	Total.
I.	37·07	17·42	10·81	0·68	—	32·77	0·51	0·53	99·79
II.	37·79	11·97	15·77	1·31	0·31	32·57	0·37	—	100·18

L. J. S.

Sanidine from the Leilenkopf, Lake Laach. Rheinhard Brauns (*Jahrb. Min.*, 1909, i, 43—57).—A description is given of the sanidine bombs found in volcanic tuff at the Leilenkopf near Niederlützingen. Analysis by M. Lubinski gave:

SiO_2.	Al_2O_3.	BaO.	Na_2O.	K_2O.	Fe.	Total.	Sp. gr.
63·89	20·66	0·94	2·22	12·60	trace	100·31	2·57

L. J. S.

Fused Mixtures of Oligoclase with Enstatite and Augite. Marg. Schmidt (*Jahrb. Min. Beil.-Bd.*, 1909, 27, 604—641. Compare Doelter, Abstr., 1906, ii, 665).—Mixtures of oligoclase and enstatite and of oligoclase and augite in various proportions (every 10%) were fused, and determinations made of the intervals of the melting points of the quickly-cooled glassy material and of the slowly-cooled crystalline product, and also of the temperature during the interval of crystallisation. The results are plotted on curves, and the microscopic structure of the crystalline products is described. L. J. S.

Laterite from Brazil. Albert Atterberg (*Centr. Min.*, 1909, 361—366).—Three samples of laterite from the neighbourhood of Rio de Janeiro were examined: I, from Santa Teresa; II, from Corcovado, and III, from Serra de Itatiaya. The material from the first two localities has been derived by the weathering of gneiss, whilst that from the third locality owes its origin to nepheline-syenite. A preliminary sieving of the material separated 38·2, 37·5, and 8·0% respectively of gravel and coarse sand. The finer material was then digested with hydrochloric acid, and afterwards with sodium hydroxide; the soluble portions gave the results under I*a*, II*a*, III*a* respectively (calculated to 100% of the laterite). The insoluble residue was then separated by sedimentation in water into a finer clayey portion (16·7, 12·4, and 29·8%), coarser clay, and a fine sandy portion. The finer clayey portions gave on analysis the results under I*b*, II*b*, III*b*; and the fine sandy portion of I (10·6% of the whole) gave I*c*.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Moisture.	Total.
I*a*.	6·30	—	5·91	6·68	nil	0·16	0·23	0·64	—	—	19·92
II*a*.	5·00	—	7·93	6·16	0·07	0·21	0·06	0·08	—	—	19·51
III*a*.	1·54	—	11·92	4·51	nil	0·02	0·33	0·04	—	—	18·36
I*b*.	[39·44]	3·68	36·18*	—	,,	0·20	0·60	0·50	15·00	4·40	100·00
II*b*.	[40·87]	3·03	37·93*	—	,,	trace	0·79	0·88	13·60	2·90	100·00
III*b*.	[42·61]	3·61	36·61*	—	,,	0·12	0·40	0·30	14·30	2·02	100·00
I*c*.	[39·87]	5·60	33·50	1·71	trace	0·27	2·80	0·91	13·01	2·33	100·00

* Including a little Fe_2O_3.

From these analyses it will be seen that, besides quartz and iron hydroxide, the material consists largely of kaolin (or of the soluble form nacrite), and that only in III is there any appreciable amount (21%) of hydrargillite. It thus appears that while some laterites consist largely of hydrargillite, others consist largely of kaolin.

L. J. S.

French Sub-alpine Tertiary Basalts. Albert M. Levy (*Compt. rend.*, 1909, **148**, 1528—1531).—The degree of acidity of an igneous rock is represented by the symbol $\phi = S/(2K + 3Na)$, where, S, K, and Na are the percentages of silica, potassium, and sodium in the colourless constituents of the rock. In neutral rocks, where $\phi = 1{\cdot}9$, albite and orthoclase predominate. When ϕ is less than 1·9, the rock is of the eleolitic or leucite (basic) type; when ϕ is greater than 1·9, the rock is of the acidic granite, syenite, or tonalite type. Most French tertiary and quaternary rocks are of the acidic type ($\phi > 1{\cdot}9$), but towards the east in sub-alpine districts, as well as in Germany and Bohemia, the rocks with but few exceptions are neutral or basic. The French nephelinic basalts analysed by the author are distinctly basic. The general classification of igneous rocks into Atlantic (basic) and Pacific (acidic) types according to chemical and geographical characteristics appears to be invalidated by numerous exceptions.

R. J. C.

Rocks from the Eastern Border of the Armorican Massif. L. Vandernotte (*Compt. rend.*, 1909, **148**, 1202—1205).—A description is given of the different rock types met with in the Massif of Ernée, near Laval (dep. Mayenne). Analyses are given of: I, normal gabbro; II, olivine-gabbro; III, gabbro-norite.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	51·30	0·32	18·20	1·28	5·10	9·35	12·79	1·80	0·25	0·31	100·70
II.	48·70	1·18	17·95	0·76	6·48	8·20	13·36	1·90	0·47	0·70	99·70
III.	53·50	1·63	15·01	—	9·45	7·05	10·30	2·50	0·52	0·50	100·46

L. J. S.

Meteorites of Cañon Diablo. George P. Merrill and Wirt Tassin (*Zeitsch. Kryst. Min.*, 1909, **46**, 386; from *Smithsonian Miscell. Collections*, 1907, **50**, 203—214).—Meteorites of a new type from Cañon Diablo consist of a nucleus of iron surrounded by iron shale. The former contains schreibersite (anal. I and II), cohenite (III), some kamacite, taenite (IV), and a small amount of olivine (V):

	Fe.	Ni.	Co.	Cu.	P.	C.
I.	63·04	23·07	0·03	—	13·80	—
II.	58·54	26·08	0·05	trace	15·37	—
III.	91·29	2·48	0·10	—	0·01	5·96
IV.	72·16	27·75	0·02	—	0·04	0·12

	SiO_2.	MgO.	FeO.	NiO.
V.	41·51	52·70	5·89	0·29

L. J. S.

The Supposed Meteorite ("Leucite-uranolith") of Schafstädt, near Merseburg. Max Belowsky (*Centr. Min.*, 1909, 289—293).—This supposed meteoric stone described by C. Klein (Abstr., 1904, ii, 351) as the representative of a new "leucite-uranolith" group of meteorites, and unique (amongst meteorites) in containing leucite, is nothing more than a piece of leucite-basanite lava from Vesuvius.

L. J. S.

Physiological Chemistry.

An Apparatus for Studying the Respiratory Exchange. Francis G. Benedict (*Amer. J. Physiol.*, 1909, 24, 345—374).—The apparatus used in the respiration calorimeter is modified for use in a movable form of apparatus. The same main principles are employed, and the apparatus was found to give good results. It is described in full with drawings and diagrams. W. D. H.

Cheyne-Stokes Breathing. Regulation of Breathing. C. Gordon Douglas and John S. Haldane (*J. Physiol.*, 1909, 38, 401—419, 420—440).—Periodic or Cheyne-Stokes breathing can be easily produced in normal people, and comes on after the apnœa which follows forced breathing. It is produced by the periodic occurrence and disappearance of the indirect excitatory effects of want of oxygen on the respiratory centre. The want of oxygen may be due to abnormal deficiency in the alveolar oxygen pressure, or to the effects on the circulation of changes in the breathing, or to both causes.

The second paper is a discussion of the part played by various chemical factors in the regulation of normal breathing. It is shown that the respiratory centre acts smoothly, because some time is needed for it to become saturated or desaturated to the carbon dioxide capacity of the circulating blood. But for this, the centre would undoubtedly "hunt" like the governor of an engine without a fly-wheel. When the excitation of the centre depends partly or wholly on want of oxygen, this fly-wheel action is absent, and periodic breathing is the result. W. D. H.

Blood-coagulation. P. Morawitz (*Biochem. Zeitsch.*, 1909, 18, 30—33).—Polemical against Mellanby (compare this vol., ii, 158).

W. D. H.

Oxidative Processes in the Blood. P. Morawitz (*Arch. exp. Path. Pharm.*, 1909, 60, 298—311).—*In vitro*, the blood of rabbits suffering from sub-chronic experimental anæmia uses up oxygen and gives rise to carbon dioxide, especially at body temperature. This appears to be related to the formed elements, and the question whether it is specially connected with the regenerative process is to be further investigated. W. D. H.

Action of Salts of Unsaturated Fatty Acids in Hæmolysis. BENJAMIN MOORE, FRED P. WILSON, and LANCELOT HUTCHINSON (*Proc. physiol. Soc.*, 1909, lxxiii—lxxiv; *J. Physiol.*, 38).—Bile salts dissolve free fatty acids, soaps, lecithin, and cholesterol at body temperature. The solubility of saturated fatty acids and soaps is increased by the presence of oleic acid or oleates. Lecithin also increases the solubility of soaps and cholesterol. Recent work on hæmolysis, and on sodium oleate as an anti-complement, gives a new aspect to these solubilities. All substances not acting as solvents which have marked hæmolytic properties (such as saponins and bile salts) are all unsaturated with doubly linked carbon atoms. Sodium stearate and palmitate have no laking power, but sodium erucate, oleate, and linoleate have. The linoleate has the greatest number of doubly linked carbon atoms, and the strongest action on the corpuscles. W. D. H.

Quinine and Blood-pigment. LOUIS LEWIN (*Arch. exp. Path. Pharm.*, 1909, 60, 325—327).—The brown pigment which has been described as the specific result of the action of quinine on the blood is merely methæmoglobin, the spontaneous formation of which in the blood, especially in old blood, is somewhat hastened by the presence of quinine and certain other alkaloids (morphine and cocaine). W. D. H.

Vasodilatin. The Active Substance of Extracts of All Parts of the Digestive Canal, Brain, Pancreas, and Peptone. LEO POPIELSKI and K. PANEK (*Pflüger's Archiv*, 1909, 128, 222—225).—Vasodilatin is the name given to a substance in extracts of the alimentary canal, brain, pancreas, and Witte's peptone, which is believed to produce the lowering of blood-pressure. It is not precipitated by lead acetate, but it is precipitated by phosphotungstic acid. It is soluble in absolute alcohol; it is not choline or any other alkaloid; it is not a protein. Its identification is uncertain. W. D. H.

Digestion in the Animal Body. XXVIII. E. S. LONDON. **XXIX.** E. S. LONDON and A. SIVRÉ. **XXX.** E. S. LONDON. **XXXI.** E. S. LONDON and N. A. DOBROWOLSKAJA. **XXXII.** E. S. LONDON and F. J. RIWOSCH-SANDBERG (*Zeitsch. physiol. Chem.*, 1909, 60, 191—193, 194—266, 267—269, 270—273, 274—283. Compare Abstr., 1908, ii, 1050).—XXVIII deals with further variations in the poly-fistula method in dogs. XXIX works out further details concerning the digestion and absorption of fat, starch, and flesh, given either alone, in pairs, or all three at once, so as to ascertain the influence exerted on the rate of digestion and absorption of each by the other two on the lines of the author's previous researches. XXX deals with the digestion and absorption of elastin, which are much slower than for other proteins. XXXI shows that the author's laws of digestion and absorption previously worked out for protein hold good also for carbohydrates. XXXII deals with the absorption of certain amino-acids; *d*-alanine given alono is somewhat better absorbed than when in a digested mixture; it is absorbed better than *l*-alanine, and also better than glycine. The amino-acids given produce a large flow of intestinal juice. W. D. H.

The Effects of Bone Ash on Digestion and Metabolism. ALFRED PEIRCE LOTHROP (*Amer. J. Physiol.*, 1909, 24, 297—324).—In metabolism experiments on dogs, a convenient method of separating the fæces consists in the administration of bone ash at given intervals. It is therefore necessary to determine what changes, if any, are produced by the bone ash itself. Beyond an increase in bulk, and frequency of elimination of the fæces, it was found to produce no effect on the digestive, absorptive, or metabolic processes of the body. W. D. H.

Can Nitrogenous Equilibrium be Maintained on Diets Containing Zein or Gliadin as the only Nitrogenous Constituents? VALDEMAR HENRIQUES (*Zeitsch. physiol. Chem.*, 1909, 60, 105—118).—It has been already shown by Hopkins and Wilcock that nitrogenous equilibrium cannot be maintained on a diet containing zein, which does not yield tryptophan as a product of hydrolysis. These experiments have been extended by the author, who has also carried out similar researches with gliadin, which yields tryptophan on hydrolysis and large quantities of glutamic acid, but not lysine. Rats were employed as the subjects of the experiments, and the intake and output of nitrogen were estimated, definite quantities of the nitrogenous food being in each case added to standard diets containing carbohydrates, fats, and salts. It was found that whilst nitrogenous equilibrium cannot be maintained on a diet containing zein as the only nitrogenous component, the loss of nitrogen was appreciably less than when the diet was quite nitrogen-free. With gliadin, if given in sufficient quantity, on the other hand, not only can nitrogenous equilibrium be maintained, but a storage of nitrogen in the organism can take place. S. B. S.

Nuclein Metabolism, and its Relationship to the Nuclein Ferments in the Human Organism. MILTON C. WINTERNITZ and WALTER JONES (*Zeitsch. physiol. Chem.*, 1909, 60, 180—190).—Nuclease hydrolyses nucleic acid with the formation of guanine and adenine; amidases (guanase and adenase) decompose guanine and adenine, with scission of ammonia into xanthine and hypoxanthine, and lastly, xantho-oxydase oxidises hypoxanthine into xanthine and uric acid. Little is known as to the distribution of these various ferments in the human body, and their distribution was therefore investigated in the organs taken from subjects who had suffered from two widely different diseases, namely, typhus and aneurism. In both cases similar results were obtained, and these may be regarded as typical of the normal distribution. The liver and spleen were found to be incapable of changing adenine into hypoxanthine. The liver, on the other hand, can convert guanine into xanthine, and oxidise the latter substance into uric acid. The results differ from those obtained from corresponding organs of the pig. S. B. S.

The Absorption of Purine Substances. JOH. BIBERFELD and JULIUS SCHMID (*Zeitsch. physiol. Chem.*, 1909, 60, 292—297).—The lymph of dogs and cats after feeding on milk and meat contains no purine substances; the same is true after abundant feeding on nucleic acid. The excretion of the catabolic products of nucleic acid begins early, and is completed within twenty-four hours, as the ratio between uric acid and total nitrogen in the urine shows. W. D. H.

The Origin and Destiny of Cholesterol in the Animal Organism. Part V. On the Inhibitory Action of the Sera of Rabbits Fed on Diets Containing Varying Amounts of Cholesterol on the Hæmolysis of Blood by Saponin. MARY T. FRASER and JOHN A. GARDNER (*Proc. Roy. Soc.*, 1909, *B*, 81, 230—247).—Cholesterol combines with saponin and thus inhibits its hæmolytic action on blood corpuscles. The esters do not possess similar action. The antihæmolytic action of sera when suspensions of corpuscles are treated with saponin was therefore investigated in order to determine whether cholesterol was present in these sera taken from rabbits which had been receiving diets containing in some cases cholesterol and in others none; in these cases the quantities are too small for estimation of chemical methods. It was found that when cholesterol is in the food of rabbits, some is absorbed and finds its way into the blood-stream as free cholesterol, only a portion of the total ingested being absorbed, the rest being excreted unchanged. The amount of cholesterol which finds it way to the blood-stream is not increased by increasing the amount given in food, and the animals appear to take up only such amounts as they can utilise. When ingested in the form of esters, the latter undergo hydrolysis in part during digestion, and cholesterol appears free in the blood-stream. Phytosterol appears to act like cholesterol, in that it is absorbed, but it is not yet known whether it appears in the blood-stream as such, or is converted into cholesterol. S. B. S.

Cerebro-spinal Fluid. Nature of the Reducing Substance. Analysis of Fluid from a Hydrocephalous Case. W. MESTREZAT (*J. Pharm. Chim.*, 1909, [vi], 29, 472—481).—Analyses of cerebro-spinal fluid taken from a hydrocephalous infant during life and after death gave the following results, expressed in parts per 1000: (1) *Fluid withdrawn during life.*—Extract dried at 110°, 10·6, ash 8·2, chlorides (as NaCl) 6·95, protein 0·35, dextrose 0·48—0·51, organic matter, other than dextrose, 1·92, Δ 0·55°. The fluid was limpid, colourless, and slightly alkaline to litmus. (2) *Fluid withdrawn after death.*—Extract dried at 110°, 10·93, ash 9·00, chlorides (as NaCl) 7·66, CaO 0·087, Na_2O 4·13, K_2O 0·37, Cl 4·64, SO_3 0·080, P_2O_5 0·012, carbonic acid and organic acids (expressed as lactic acid) 2·09, protein 0·17, organic matter 1·93, water 989·07, Δ 0·60°. There were also traces of dextrose, iron, nitrates, and nitrites (due to reduction of nitrates) present, but no albumoses, peptones, amylase, urea, or uric acid could be detected. The fluid was limpid and slightly alkaline to litmus.

Both specimens were normal in their content of mineral matter, although the "dry extract" was a little low, and also the lime and phosphoric oxide, as is generally found in hydrocephalous cases. The protein consisted of a mixture of serin and globulin. Dextrose was identified by the preparation of its phenylosazone. The conflict of opinion as to whether the reducing power of cerebro-spinal fluid is due to dextrose or to some other substance is explained by the observation that these specimens contained dextrose and a second reducing substance, which is precipitated in the defecation of the fluid by mercuric nitrate. This substance does not appear to be catechol, since it gives no coloration with ferric chloride, but it may be glycuronic acid or a derivative of this. It does not always occur in cerebrospinal fluid, but is usually found when there is little dextrose present. The original contains numerous references to previous work on this and associated subjects. T. A. H.

Lecithins and Cholesterols Contained in the Sperma and Ovary of Tunny Fish. SERAFINO DEZANI (*Giorn. R. Accad. Med. Torino*, 1909, 15).—The lecithin extracted by alcohol from the testicles and ovary had practically the same composition, and yielded 30—33% of oleic acid and 67—70% of palmitic and stearic acids. Ethereal extracts yielded lecithins containing much more oleic acid (45 and 48% respectively).

Cholesterol from sperma gave results agreeing with the formula $C_{27}H_{44}O,H_2O$, and has the properties of cholesterol obtained from other animals; m. p. 138—145°. The substance obtained from the ovary has the same composition, but gives no coloration with sulphuric acid. When treated with chloroform and sulphuric acid, a coloration appears in about an hour, and in twelve hours the chloroform layer has a reddish-violet colour, whilst the sulphuric acid shows a green fluorescence. M. p. 100—104°. It is doubtful whether the substance is a distinct compound, or whether its different behaviour is due to impurities. N. H. J. M.

Action of Salts on Autolysis. LUIGI PRETI (*Zeitsch. physiol. Chem.*, 1909, 60, 317—340).—Ferric chloride, sulphate, and oxalate, manganese chloride, sulphate, and lactate, aluminium chloride and sulphate, and cobalt nitrate added to the liver in small quantities during autolysis increase the amount of non-coagulable nitrogen; this increase is progressive as more salt is added. Manganese acetate and cobalt chloride act in the same way at first, until the amount of salt reaches a certain height, beyond which they produce the opposite result. Platinum chloride beyond a certain point gives variable results. Sodium chloride and sulphate and copper sulphate at first produce no effect, but beyond a certain concentration lessen the non-coagulable nitrogen. Palladium chloride, calcium chloride, barium chloride, and strontium chloride and bromide have no effect. Cadmium chloride, nickel chloride and nitrate, magnesium chloride, and zinc sulphate lessen the non-coagulable nitrogen; this, however, occurs before it can affect the autolytic process. W. D. H.

Influence of Narcotics of the Fatty Series on Autolysis. RICHARD CHIARI (*Arch. exp. Path. Pharm.*, 1909, 60, 256—264).—Narcotics at first accelerate autolysis, because they dissolve lipoids and so allow free entry of the enzymes to the protoplasm of cells.

W. D. H.

The Fat of the Liver, Kidney, and Heart. II. PERCIVAL HARTLEY (*J. Physiol.*, 1909, 38, 353—374).—The following higher fatty acids are present in the liver: palmitic, stearic, oleic, linoleic, and one with the formula $C_{20}H_{32}O_2$. The double linking in liver-oleic acid lies between the sixth and seventh carbon atoms reckoning from the methyl-group end of the chain, whereas that from adipose tissue is exactly in the middle of the chain. Some evidence was obtained of the presence of two linoleic acids in the liver. The occurrence of the acid $C_{20}H_{32}O_2$ is shown by the formation of octabromoarachidic acid on bromination, and of its hydroxy-derivative on oxidation. The unsaturated acids account for approximately one-half of the acids present. The acid $C_{20}H_{32}O_2$ occurs to the extent of about 10% of the total fatty acids, and linoleic is more abundant than oleic acid. The high iodine value and the ease with which atmospheric oxygen is taken up are due to the presence of linoleic acid and the acid $C_{20}H_{32}O_2$. The unsaturated acids are present to a large extent in lecithin and similar substances.

W. D. H.

Occurrence of Mixed Glycerides in Natural Fats. ISIDOR KLIMONT and E. MEISELS (*Monatsh.*, 1909, 30, 341—346).—To the list of fats containing mixed glycerides is to be added the fat of the domestic goose and of the domestic duck. Goose fat (D^{15} 0·9270, saponification number 193·3, iodine number 70·1), when crystallised from acetone containing a little chloroform, gives a *substance*, m. p. 59°, saponification number 203·0, the mixture of fatty acids from which has m. p. 56·5° and acid number 209·3. These numbers agree with those of a mixture of palmitic acid (2 mols.) and stearic acid (1 mol.), m. p. 55·1°. Duck fat (D^{15} 0·912, m. p. 27—28°, saponification number 193·6, iodine number 71·7), when crystallised from acetone and chloroform, gives a *substance*, m. p. 59—60°, saponification number 203·9, the fatty acids from which have m. p. 54—55° and acid number 209·7. The *substances* are probably identical with Guth's α-stearyldipalmitin or β-stearyldipalmitin (Abstr., 1903, i, 225). Repeated crystallisation of a mixture of tristearin and tripalmitin yields finally a mixture of constant m. p., 66°, containing 70% tristearin and 30% tripalmitin.

C. S.

The Milk of a Woman Sixty-two Years Old. SIGMUND FRANKEL (*Biochem. Zeitsch.*, 1909, 18, 34—36).—The milk obtained differs in no chemical way from that of normally lactating women.

W. D. H.

The Parent Substance which is the Cause of the Cammidge Reaction in Urine. K. SMOLENSKI (*Zeitsch. physiol. Chem.*, 1909, 60, 119—130).—Cammidge has shown that in many cases of acute diseases of the pancreas, urine is excreted, which, after boiling with acids (and only after boiling), gives a reaction with phenylhydrazine, and readily reduces Fehling's solution. These reactions have been shown by the author to be due to the presence of sucrose, by the investigation of the optical properties of the urine, both before and after hydrolysis with acids (inversion), by the identification of the phenylhydrazine precipitate obtained by Cammidge's method, and by the isolation of the disaccharide from urine in the form of its strontium compound. The output of sucrose in the urine could be markedly increased if larger quantities of this sugar were ingested. It is suggested that the phenomenon of sucrose excretion in urine should be termed "saccharosuria." The case investigated by the author was shown by subsequent post-mortem examination to be one of cancer of the stomach. The pancreas was, however, normal. S. B. S.

The Biological Action of Salts. I. Ernst Schloss (*Biochem. Zeitsch.*, 1909, 18, 14—21).—The special point investigated was the influence of salts on the body temperature of children. The univalent cations sodium and potassium appear to be the carriers (Träger) of the temperature-elevating function, and the bivalent cation calcium that of the temperature depressing function. W. D. H.

Action of Alkali Salts on Ciliated Epithelium. Rudolf Höber [with M. Iwaschkiewitsch] (*Biochem. Zeitsch.*, 1909, 17, 518—542). —The tissue employed was the mucous membrane from the frog's throat. The action of ions and cations was investigated separately. The anions can be arranged in the following order: I, Br, NO_3, Cl, SO_4, the ciliary movement being arrested most rapidly in iodides, and least rapidly in chlorides and sulphates. The action of the cations is more complex; they can be arranged, however, in the following order: Li, Cs, Na, NH_4, Rb, K. Lithium and cæsium have the strongest action, and rubidium and potassium the weakest. This order of anions and cations is similar to that which has been found in other physiological phenomena, and in the precipitation of certain colloids. S. B. S.

The Action of Salts on Toxin and on Toxin-antitoxin Combinations in Presence of Serum Proteins. Ernst P. Pick and Oswald Schwarz (*Biochem. Zeitsch.*, 1909, 17, 491—517).—The toxicity and the effect of toxin-antitoxin combination was tested in the usual way by injecting the mixtures into mice. It was found that salts with monad cation, such as sodium chloride, sodium sulphate, ammonium sulphate, thiocyanate, and bromide, which have no action on diphtheria or tetanus toxin, exert no influence on the combination between the toxins and antitoxins in relatively high concentration; nor is the combination toxin-antitoxin destroyed by these salts. Calcium and aluminium ions act on the tetanus toxin, which, however, can be protected from the destructive action by the presence of an immune serum; they also act on the toxin-antitoxin combination; the more stable the latter is the more energetic the action of the metallic ions. Magnesium salts act in the reverse way, namely, the magnesium ion exerts its action when the toxin is added to the serum-salt mixture; it acts but little on the toxin-antitoxin combination. The authors offer an explanation of the phenomena, in which they assume that the neutralisation phenomena of toxin by antitoxin proceeds in two phases, namely, the phase of colloidal adsorption and the phase of the specific saturation of the toxin. Salts of univalent and bivalent metals in the concentrations investigated act neither on the toxin nor antitoxin, nor on the combination of the two, in the case of the diphtheria toxin. S. B. S.

Action of the Digitalin Group on the Heart. N. Werschinin (*Arch. exp. Path. Pharm.*, 1909, 60, 328—339).—Frogs' hearts perfused with Ringer's solution containing 0·5 mg. of strophanthin or digitoxin are brought into a condition of systolic standstill, whereas weaker concentrations stop the heart in diastole. The action is greater if the perfusing fluid contains about one-third of rabbit's blood or rabbit's serum; then doses which ordinarily govern diastole bring about systolic stoppage. W. D. H.

Action of Picrotoxin on the Autonomic Nervous System. Hermann Friedrich Grünwald (*Arch. exp. Path. Pharm.*, 1909, 60, 249—255).—The investigations show that picrotoxin acts in a toxic manner on the central portion of the autonomic nervous system. Related substances, such as toxiresin and digitalresin, have probably a similar action. W. D. H.

Pharmacological Investigation of Tetrahydronaphthylamine. D. Jonescu (*Arch. exp. Path. Pharm.*, 1909, 60, 345—359).—This substance produces a rise of blood-pressure, but differs from adrenaline in its action in several ways. It does not excite the vagus centre; its action on the sympathetic system is both central and peripheral; it produces mydriasis, contraction of peripheral vessels, and of other varieties of plain muscle. It has no action on glands, and does not cause glycosuria. W. D. H.

Mechanism of the Action of Atoxyls. Wilhelm Roehl (*Chem. Zentr.*, 1909, i, 1666; from *Berlin. klin. Woch.*, 1909, 46, No. 11).—The chief process is that of reduction, which leads to the formation of *p*-aminophenylarsenious oxide. This view is in agreement with the action of arsenic trioxide, and also with all known phenomena. It is neither necessary to assume the reduction product first unites with albumin to produce a toxalbumin (Levaditi), nor that the organisms must be in some definite relationship with the body-cells (Uhlenhuth). J. V. E.

Acid Poisoning. Julius Pohl (*Biochem. Zeitsch.*, 1909, 18, 24—29).—Eppinger regards amino-acids and urea as substances which neutralise the toxic effects of acids, because they give rise to ammonia. The present experiments on herbivora (rabbits) lend no support to this idea. The administration of proteins, amino-acids, and urea has no such protective action against mineral acids. W. D. H.

An Improved Method of Desiccation. L. F. Shackell (*Amer. J. Physiol.*, 1909, 24, 325—340).—The method of drying is improved (1) by the production of a high vacuum by the Geryk pump; (2) by freezing the material prior to desiccation, and (3) by keeping the sulphuric acid absorbent well mixed throughout. Liquids need not be frozen, but can be absorbed on dry sand. The method is very rapid, and the materials dried are not chemically altered. It ought to be specially valuable in the drying of the serums, etc., used in serum therapy. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Metallic Filter with Adjustable Uniform Interstices Reducible to Ultramicroscopic Dimensions. Émile Gobbi (*Compt. rend.*, 1909, 148, 1126—1128).—The Chamberland filter and others of the same kind retain bacteria and fine particles for a certain time only. The action of the filter is to pass the liquid through long canals, which, although wide enough to pass small particles, cause them to be arrested by surface action. The author's filter aims at arresting bacteria and colloid particles by the uniform minuteness of the interstices of the filter, whilst not impeding the liquid by long canals. The filter is composed of several hundred metres of nickel ribbon 0·1 mm. thick, 1·5 mm. wide, rolled spirally on its flat face to make up a cylinder. The ribbon has a series of tiny ribs on one side of it very close together, so that when the filter is tightened by screwing up the ribbon the size of the interstices depends on the height of the ribs. Liquid friction is small, since it depends on the width of the ribbon employed—in this case 1·5 mm.

Seine water, filtered under a pressure of 30 metres, remained quite sterile even when the filter had been in continual use for several days. Solutions of neutral-red and Magdala-red were entirely decolorised by filtration, but methyl-violet was only partly retained. In presence of 2% of sodium chloride, however, the latter dye was apparently polymerised, and was retained by the filter for some hours. R. J. C.

The Influence of Glucosides on the Growth of Acid-fast Bacilli, with a New Method of Isolating Human Tubercle Bacilli Directly from Tuberculous Material Contaminated with Other Micro-organisms. F. W. Twort (*Proc. Roy. Soc.*, 1909, *B*, 81, 248).—Investigations were undertaken with the object of determining the action of acid-fast bacilli on glucosides, of which forty-three were tested; no evidence was obtained of any fermentative action. One glucoside, ericolin, was found to kill a large number of species of micro-organisms, but had little effect on acid-fast bacilli. If sputum is treated with a 2% ericolin solution at 38° for from three-quarters to one hour, most of the other organisms are killed; the tubercle bacilli are unaffected, and by sub-culturing on to Dorset's medium, and again sub-culturing from this if necessary, a pure strain of tubercle bacilli is easily obtained.

S. B. S.

Bacillus amylobacter A. M. et Bredemann. G. Bredemann (*Centr. Bakt. Par.*, 1909, ii, 23, 385—566).—A long treatise on this organism in its various relationships. It fixes nitrogen, decomposes carbohydrates with formation of alcohol and volatile acids, and is characterised by its property of making and storing glycogen, a property shared by few other micro-organisms. The method of examining the volatile acids was to prepare a mixed barium salt from the distillate and determine the percentage of barium in the mixture. So far as the method can be depended on, it fails to indicate any difference between the cultures obtained from different sources, and to this extent shows that the limits within which the organism is liable to variation are narrow.

A full bibliography is appended. E. J. R.

The Growth of Bacillus tuberculosis and Other Micro-organisms in Varying Percentages of Oxygen. Benjamin Moore and R. Stenhouse Williams (*Bio-Chem. J.*, 1909, 4, 177—190). —*Bacillus tuberculosis* either does not grow at all, or grows very badly in the entire absence of oxygen or in presence of a partial pressure of oxygen amounting to 80 to 90% of an atmosphere. *Staphylococcus aureus* and *S. albus* behaved in a similar way. On the other hand, *B. coli*, *typhosus*, *diphtheriae*, and *dysenteriae* (Kruse) grew equally well both in air and oxygen; two other forms of *B. dysenteriae* make less growth in oxygen than in air, whilst *S. citreus* showed certain differences in the manner of growth. E. J. R.

The Stereochemistry of Lactic Acid Fermentation. Reginald O. Herzog and F. Hörth (*Zeitsch. physiol. Chem.*, 1909, 60, 131—151). —The action of various bacteria capable of producing lactic acid was investigated, and a bouillon medium containing different sugars was employed. The amount of lactic acid, its optical properties, and the amount of unchanged sugars after bacterial action were determined. It was found that both aldehyde and ketone alcohols, as well as substances containing alcohol groups alone (such as mannitol), formed satisfactory substrates for lactic acid fermentation; also, in some cases, pentoses, hexoses, disaccharides, and methylglucoside. Glycerol, erythritol, and dulcitol were unattacked. In some cases the quantity of lactic acid formed corresponded with the amount of sugar which had disappeared from the substrate after fermentation; in other cases there was a loss. The lactic acid formed was in most cases optically active. The form of the lactic acid appears to depend on the nature of the ferment rather than on the configuration of the substrate. S. B. S.

Citric Acid Fermentation by Citromycetes. Eduard Buchner and Hermann Wüstenfeld (*Biochem. Zeitsch.*, 1909, 17, 395—442).—The conditions under which the micro-organisms of various origin will develop from dextrose the maximum amount of citric acid were investigated. As source of nitrogen, inorganic salts, decoction of white beans, and beer-wort were employed. The most favourable results were obtained from the organic sources of nitrogen. Good yields of the acid were obtained only in the presence of calcium carbonate; if this were absent, the citric acid appeared to be to a great extent destroyed by the micro-organism. The largest yield of citric acid from dextrose was obtained by *Citromycetes citricus* from a solution poor in nitrogen and containing 13% dextrose; in this case the yield of citric acid was 55% of the weight of sugar employed. Investigations were also undertaken with a view to throwing light on the chemical mechanism of the reaction. It is conceivable that citric acid could be derived from a condensation of two molecules of acetic acid and one molecule of oxalic acid, which could be formed as intermediate products from the sugar. No citric acid was obtained, however, when the micro-organism was grown on media containing the two above-mentioned acids. Negative results were also obtained when attempts were made to produce alcohols by the deamidisation of amino-acids. The expressed juice of the organisms was incapable of producing citric acid. S. B. S.

Effect of Different Bases on the Changes of Ammonia and Nitrate Nitrogen. Otto Lemmermann, H. Fischer, and B. Husek (*Landw. Versuchs-Stat.*, 1909, 70, 317—334). **Effect of Lime on Soil Bacteria.** H. Fischer (*ibid.*, 335—342).—The results of experiments with liquid cultures showed that nitrogen in the forms of ammonia and nitrates is to a considerable extent converted into proteins by soil organisms. The conversion is greater in the case of ammonium salts than with nitrates. The proteins thus formed are soon decomposed.

Calcium carbonate distinctly increases the production of protein from ammonia, but has very slight, if any, effect on the conversion of nitrates. Barium carbonate considerably increases protein formation from ammonium salts, and has a retarding effect in the case of nitrates. Magnesium carbonate and ferric hydroxide diminish the conversion of ammonium salts into protein, and ferric hydroxide acts similarly with nitrates.

The lower manurial effect of ammonium salts as compared with nitrates may be due, in part, to the greater readiness with which ammonia is converted into proteins; loss of ammonia due to the presence of calcium carbonate in the soil is too slight to account for the difference.

Calcium hydroxide has a much greater influence on soil organisms than calcium carbonate. N. H. J. M.

Presence of Indole-producing Substances in Culture Bouillon. Charles Porcher and L. Panisset (*Compt. rend.*, 1909, 148, 1336—1338).—Liquid bacterial cultures which have been freed from indole by extraction with ether yield a further quantity of this substance when distilled in steam. This arises from the decomposition of certain indole-derivatives, such as indolecarboxylic acid, which are formed in the bacterial decomposition of tryptophan.

W. O. W.

The Chemical Permeability of Living Algæ and Protozoa to Inorganic Salts and the Specific Action of the Latter. MARGHERITA TRAUBE-MENGARINI and ALBERTO SCALA (*Biochem. Zeitsch.*, 1909, **17**, 443—490).—The majority of the experiments were made with *Cladophora* and *Spirogyra*, and the authors describe the morphological changes when these organisms are immersed in various salt solutions. It was found that sodium chloride in 0·7% solution in pure distilled water was less injurious to the organism than the corresponding isoelectric solution of potassium chloride, and the latter salt was less injurious than magnesium chloride. In the presence of small quantities of carbonates of the alkaline earths, the injurious action was in the order $MgCl_2 < NaCl < KCl$. The injurious action was manifested in a different way with each of these salts. With more concentrated solutions (2—4%) of sodium chloride in distilled water, the same phenomena take place in a half-hour as take place in the weaker solutions after several days. In this case a marked formation of free mineral acids takes place within the cells. The place of permeability of salts has been localised in the various organisms. A hypothesis is suggested to explain the action of salts, based on the assumption that certain salt-protein compounds can be formed. S. B. S.

Respiratory Gaseous Exchanges in Aerial Vegetal Organs of Vascular Plants. G. NICOLAS (*Compt. rend.*, 1909, **148**, 1333—1336).—The leaves of vascular plants are distinguished from the stalks by the rapidity with which gaseous interchange takes place at their surface. With respect to gaseous transpiration and circulation, the difference between the leaves and stalk is comparable with that shown to exist between leaves in their normal state and those which have been coated with vaselin or glycerol. W. O. W.

Permeability of the Plasma Membrane for Dissolved Substances. W. W. LEPESCHKIN (*Ber. Deut. bot. Ges.*, 1909, **27**, 129—142).—The author measures the increase in size of the *Spirogyra* cells when placed in the solution under investigation, and deduces therefrom the isotonic coefficient. It is pointed out that the method has only a limited application, and breaks down if the cells have to remain so long in the solution that the permeability of the membrane alters, or if substances entering the cell react to form new substances exerting osmotic pressure. A series of measurements with sugar solution and glycerol solution are given. E. J. R.

Direct Absorption of Nitrites by Plants. F. PERCIABOSCO and V. ROSSO (*Chem. Zentr.*, 1909, i, 1497; from *Staz. sper. agrar. ital.*, 1908, **42**, 5—36).—Whilst dilute solutions of sodium nitrite have no retarding effect on the growth of plants, stronger solutions act very injuriously.

Maize plants absorb sodium nitrite in dilute solutions without previous conversion into nitrate. N. H. J. M.

The Changes Undergone by the Nucleo-protein Phosphorus in Plants. W. Zaleski (*Ber. Deut. bot. Ges.*, 1909, 27, 202—210).—The phosphorus compounds in plants include phosphates, phytin, phosphatides, nucleo-protein, and others. The phosphorus existing in the form of nucleic acid can be estimated by Plimmer's method; a scheme is also suggested for discriminating between other phosphorus compounds, and is applied to the growing ends of the bean plant. It is shown that the nucleic acid phosphorus does not change in amount when the plants are grown in water culture with sugar or in pure water. The statement made by Iwanoff to the contrary is incorrect.

E. J. R.

Composition of Shea Butter; Analysis of the Oil from the Seeds of Symphonia globulifera. Jas. E. Southcombe (*J. Soc. Chem. Ind.*, 1909, 28, 499—500).—*Shea Butter.*—A sample tested by the author showed: D^{98-99} 0·861, m. p. 29°, solidifying p. 20—21°, acid number 26·17, saponification number 178·7, iodine number 57·6. Hehner number 93·8, Reichert-Meissl number 1·15.

From a more extended analysis the composition of the insoluble fatty acids derived from the sample may be taken as oleic acid 60%, stearic acid 30—35%, lauric acid 3—4%.

Oil from the seeds of Symphonia globulifera.—The following *data* were obtained for the oil itself: D^{99-100} 0·8849, m. p. 35°, acid number 10·1, saponification number 194·6, iodine number 64·2, Hehner number 94·3, Reichert-Meissl number 1·00. The mixed fatty acids gave D^{99-100} 0·891, m. p. 48—50°, solidifying p. 46°, iodine number 64·8, unsaponifiable matter 1·1%. L. de K.

Synthesis of Salicin by means of Plants. Giacomo L. Ciamician and C. Ravenna (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 419—422. Compare Abstr., 1908, ii, 773).—The authors' previous work indicated that plants are capable of transforming saligenin, benzyl alcohol, and vanillin into glucosides, the change being a reversible one resulting in a chemical equilibrium.

A number of well-grown maize plants, as nearly equal as possible, were inoculated with saligenin. When growth was complete, it was found that the ratio of combined to free saligenin had the value 1 : 2. The same result was obtained if salicin were introduced into the plants in place of saligen. Hence, maize resembles kidney beans and hyacinths in being capable of transforming saligenin into salicin.

By means of experiments on a large number of maize plants, the authors were able to isolate the salicin formed in this way. T. H. P.

Nature of Anthocyanin. Miss M. Wheldale (*Proc. Camb. Phil. Soc.*, 1909, 15, 137—168).—The author considers that chromogen is of the nature of the flavone and xanthone classes of natural colouring matters, and exists in the plant as a glucoside. When acted on by peroxydase, the chromogen is converted into a red or purple pigment. The results are brought to bear on the phenomena observed in the genetics of flower colour. The two factors, chromogen and enzyme, are necessary in order that there should be colour; if either is absent an albino results. There appears also to be a third factor which can co-exist with these two, and which produces a blueing of the red pigment.

A full bibliography of the subject of chromogens and flower colours generally is appended. E. J. R.

The Taxine in Irish Yew, Taxus baccata var. Fastigiata. Richard J. Moss (*Sci. Proc. Roy. Dubl. Soc.*, 1909, 12, 92—96).—The author has applied the method of isolating taxine described by Thorpe and Stubbs (Trans., 1902, 81, 874) to the leaves and seeds of female trees of the Irish yew.

In the leaves of two different trees 0·623% and 0·323% of taxine were found, whilst in the seeds of the fruit from the same trees the amounts were 0·079% and 0·082% respectively. The fleshy part of the berries is quite free from taxine. The leaves of a male specimen of the common yew gave 0·082% of the alkaloid, whilst Thorpe and Stubbs obtained 0·18% from the male and 0·12% from the female tree.

The results seem to indicate that the Irish yew contains much more taxine than the common yew. By microscopical examination the author has detected signs of softening when taxine is heated at 60°, that is, 22° below the reputed m. p.

The substance is found to be partly decomposed by dilute hydrochloric acid even in the cold, a brown, humus-like substance being produced. By using 1% oxalic acid solution for extraction in place of 1% hydrochloric acid, 0·402% of taxine was isolated instead of the 0·323% recorded above. Attempts to crystallise the alkaloid were unsuccessful. E. H.

Choline, Betaine, and Trigonelline from Plants, and the Methods for the Preparation and Estimation of these Bases. Ernst Schulze (*Zeitsch. physiol. Chem.*, 1909, 60, 155—179).—The extracts of plants were first freed from the constituents precipitable by lead acetate. The liquid thus obtained could then be treated by two alternative methods. Either the excess of lead could be removed by hydrogen sulphide, the filtrate from the sulphide evaporated to dryness, the residue extracted with alcohol, and the bases precipitated from alcoholic solution by alcoholic mercuric chloride, or the bases could be precipitated by phosphotungstic acid, the precipitate thus obtained decomposed by barium or calcium hydroxide, the solution of the bases acidified by hydrochloric acid, and evaporated to dryness; from this residue the hydrochlorides were extracted by alcohol, and the bases precipitated by mercuric chloride in the way already described. When alloxuric bases and arginine were present, they could be separated, after decomposition of the phosphotungstic acid precipitate with alkalis, by means of silver nitrate, which precipitates the alloxuric bases, and by silver nitrate and baryta, which precipitate the arginine and histidine. The filtrate from these precipitates was reprecipitated by phosphotungstic acid, and the choline, etc., isolated by the method already mentioned. The mercuric double salts were recrystallised, decomposed by hydrogen sulphide, and the solution of the hydrochlorides evaporated to dryness in a vacuum. The choline could be separated from the betaine or trigonelline (which do not occur together in the same plant) by extraction with cold alcohol, in which it alone is readily soluble. S. B. S.

The Theobromine-content of Cocoa Beans. ADOLF KREUTZ (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 526—528).—The author has carried out a number of experiments, the results of which confirm his former statement that the theobromine in cocoa beans is present partly in the free state and partly combined (compare this vol., ii, 193); evidence that the theobromine is in combination as a glucoside was not, however, conclusive. About one-half of the total theobromine occurring in cocoa beans is free, and can be directly extracted with chloroform, whilst the remainder only becomes soluble after the cocoa has been subjected to hydrolysis. W. P. S.

Effect of Different Relations of Calcium and Magnesium on the Development of Plants. LUIGI BERNARDINI and G. CORSO (*Bied. Zentr.*, 1909, **38**, 304—305; from *Staz. sper. agrar. ital.*, 1908, **41**, 191).—The results of water- and sand-culture experiments with rye, wheat, and beans showed that the most suitable relations of lime to magnesia are 1 : 1, 2 : 1, and 3 : 1 respectively. In the case of field experiments no definite results were obtained. N. H. J. M.

Physiological Action and Manurial Value of the Salts of Dicyanodiamide. RENATO PEROTTI (*Chem. Zentr.*, 1909, i, 1497; from *Staz. sper. agrar. ital.*, 1908, **42**, 81—88).—Dicyanodiamide sulphate (0·05%) retards the germination of cereals and also root development. With 0·025% solutions growth is normal. The conclusion is drawn that when present in small quantities, dicyanodiamide is available as source of nitrogen for plants. N. H. J. M.

Variations in the Respective Proportions of Dextrose and Lævulose in Grape Musts. P. C. MESTRE (*Ann. Chim. anal.*, 1909, **14**, 185—187).—A useful table is given, showing the respective proportions of dextrose and lævulose in a large number of grape musts of various origin. L. DE K.

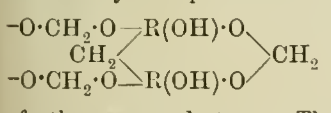
Various Destinations of Acetaldehyde in Red Wine. AUGUSTE TRILLAT (*Bull. Soc. chim.*, 1909, [iv], **5**, 546—549).—Various authors have shown that acetaldehyde occurs in wine and cognac, and the present paper gives a résumé of results of investigations on the destination of this aldehyde.

The amount present, estimated by adding phosphoric acid to the wine to decompose any aldehyde additive products and then distilling, rarely exceeds 200 mgs. per litre of wine. The amount is increased by ageing, aeration, or the presence of certain micro-organisms. The free aldehyde gradually disappears by (1) forming precipitates with the red colouring matter of the wine; (2) combination with alcohols to form acetals, which in turn precipitate the colouring matter of the wine; (3) oxidation to acetic acid, which then esterifies and contributes to the bouquet of the wine; (4) polymerisation to form resinous matters, and (5) formation of the yellow colouring matter characteristic of old wine and cognac. In the last two changes the acetals may also take part. T. A. H.

Influence of the Aldehyde of Red Wine on the Formation of Deposits. AUGUSTE TRILLAT (*Bull. Soc. chim.*, 1909, [iv], 5, 550—555. See preceding abstract).—On adding acetaldehyde to red wine, a deposit is formed either immediately or after a longer or shorter time, due to the combination of the aldehyde with the colouring matter. The quantity of aldehyde required to give a deposit with different wines varies very much, as does also the time taken for the deposit to form. A high alcohol content hinders the formation of a deposit, whilst the presence of much sugar or glycerol favours it. The deposits form equally well in the absence of air. These artificial deposits resemble in microscopic structure those formed naturally in wine. After being washed in water and dried at 100°, they yield acetaldehyde on distillation with water and phosphoric acid.

T. A. H.

Mechanism of the Fixation of the Aldehyde Residue on the Colouring Matter of Wine. AUGUSTE TRILLAT (*Bull. Soc. chim.*, 1909, [iv], 5, 555—558. Compare two preceding abstracts).—It has been shown by various authors that aldehydes furnish precipitates when added to solutions of phenols or amino-compounds, and the author suggests that these precipitates consist of condensation products of the aldehyde and phenol or amino-compound; thus with formaldehyde a product of the type $(HO)_3R{\cdot}CH_2{\cdot}R(OH)_3$ might be formed, R being an aromatic nucleus. By the continued action of formaldehyde further condensation might take place, leading to the production of compounds of the annexed type. The author has obtained evidence of the formation of such substances by the action of formaldehyde on triphenylmethane dyes, and since the latter comport themselves in the same way towards formaldehyde as does the colouring matter of wine, he suggests that this is the mechanism of the combination of this colouring matter with aldehydes. T. A. H.



"Tofu." YOGORO KATO (*Mem. Col. Sci. Eng. Kyōto*, 1908, i, 325—331).—"Tofu" is prepared in Japan from a species of beans by soaking them in water, grinding, adding water, filtering the milky suspension, and coagulating with a solution containing chiefly calcium and magnesium salts, the soft, jelly-like mass being separated from the water by straining. Tofu has hitherto been regarded as mainly a compound of casein with calcium and magnesium, but this view is now regarded as improbable, because of the small amount of ash in the residue left after the extraction of tofu with water, and more particularly with dilute hydrochloric acid. It seems probable that the calcium and magnesium exist as phosphates.

The milky suspension behaves like a typical negative colloid as regards migration of the particles with the electric current, ready coagulation on addition of salts, and microscopic appearance. Hence it is considered that the manufacture of tofu depends on the coagulation of the colloid by calcium and magnesium ions, and it is suggested that other multivalent ions might be used for the same purpose. G. S.

So-called Nitrogen-free Extract Substances in Foods. JOSEF KÖNIG and W. SUTTHOFF (*Landw. Versuchs-Stat.*, 1909, **70**, 343—403).—The not inconsiderable number of undetermined substances in the non-nitrogenous extract contain high percentages of carbon, and probably belong to the lignin group. The substances are insoluble in cold water, but dissolve when heated with water under pressure, or in dilute acids, or in glycerol-sulphuric acid (König's method). The portion dissolved by water under pressure has a lower percentage of carbon than the portion dissolved by glycerol-sulphuric acid. The latter is even higher than that of the undissolved crude fibre. The digestibility of the group dissolved by glycerol-sulphuric acid is the same as, or less than, that of crude fibre.

The amount of carbon in digested total nitrogen-free extract substance is higher than in the digested nitrogen-free crude fibre. The name "nitrogen-free extract substances," implying that the substances are readily soluble, is misleading. N. H. J. M.

Deposition of Protein from Amides. WILLI THAER (*Landw. Versuchs-Stat.*, 1909, **70**, 413—444).—Results of feeding experiments with sheep showed that the amides of molasses are practically without effect as regards deposition of protein. Asparagine seems to have a greater value, but its value in feeding is very slight. Deposition of protein depends only on protein and starch value. N. H. J. M.

Action of Carbon Disulphide and Similar Substances on Soils. K. STÖRMER (*Bied. Zentr.*, 1909, **38**, 296—298; from *Jahresber. Vereinigung angew. Bot.*, 1908, 113).—Application of carbon disulphide, carbon tetrachloride, chloroform, benzene, toluene, xylene, phenol or *o*- and *m*-cresols resulted in considerably increased production of dry matter, varying from 20·2 to 110·4%, and of nitrogen taken up by the plants (from 36·3 to 144·5%). The amounts of ammonia and of total soluble nitrogen in the soil were increased, whilst the nitrates diminished.

The first effect of such applications is to kill all injurious and beneficial organisms except a few very resistant ones. These are mostly organisms which are capable of attacking such substances as chitin, horn meal, and the residues of fungi with production of ammonia. Under these conditions the soil organisms very rapidly increase in numbers, and the growth of plants is promoted by increased breaking down of soil constituents and the decomposition of the organisms killed by the poisonous substances applied. N. H. J. M.

Manurial Action of Sodium Nitrate, Calcium Nitrate, and Calcium Cyanamide with Sugar Beet. JOSEF URBAN (*Zeitsch. Zuck-erind. Böhm*, 1909, 33, 535—547).—Calcium cyanamide gives satisfactory results, especially when there is plenty of rain; it is, however, less effective than sodium nitrate. The amount of sugar was higher (0·35%) in 1906, and lower (0·18%) in 1907, when calcium cyanamide was employed than with sodium nitrate.

Calcium nitrate, as compared with sodium nitrate (in 1907), gave an increased yield of 11·3%, and the percentage of sugar was 0·16% higher than with sodium nitrate. N. H. J. M.

Changes in Calcium Cyanamide when Stored and their Estimation. H. KAPPEN (*Landw. Versuchs-Stat.*, 1909, 70, 445—469).—No loss of nitrogen occurred when calcium cyanamide was properly stored. A slight change was observed in warm weather, probably due to the conversion of cyanamide (produced by the action of moisture and carbon dioxide) into dicyanodiamide.

Perotti's titration method, somewhat modified, yielded quantitative results with pure compounds. In some recent samples, however, there was an absence of agreement, not yet explained, between the nitrogen as cyanamide and total nitrogen. N. H. J. M.

Rational Use of Superphosphates. J. DUMONT (*Compt. rend.*, 1909, 148, 1205—1207).—It has been known for some time that when superphosphates are employed as a manure, either in the autumn or in the spring, they rapidly undergo retrogradation in the soil, owing to the formation of more basic phosphates, or of phosphates of sesquioxides, which are not so readily assimilated. The author has previously shown (Abstr., 1901, ii, 274) that when the soil is rich in humus, a portion of the phosphoric acid escapes retrogradation, being fixed by the organic matter. Experiments which have recently been carried out on the agricultural station at Grignon show that better crops are obtained when a mixture of superphosphate and ordinary manure is made some days before being applied to the ground, than when the superphosphate and manure are used in the usual way, that is, applied separately. The crops experimented on were those of beetroot, potatoes, wheat, and oats. T. S. P.

Analytical Chemistry.

Modification of the Hempel Gas Burette. J. F. SPENCER (*Ber.*, 1909, 42, 1786—1787).—The burette is fitted with a four-way tap which has two vertical, parallel branches, *a* and *b*, and one horizontal branch, *c*. Both *a* and *b* can be connected either to the burette or to the branch, *c*, but the latter cannot be connected with the burette. This arrangement obviates the inconvenience of the air-space between the burette and the absorbing liquid, since the latter can be driven from the pipette through *a* or *b* into the side-tube *c*, whereby all the air in the tubes is displaced; by turning the tap, the gas in the burette can then be brought directly into contact with the absorbing liquid in the branches *a* or *b*. P. H.

A New Electrical Method for the Continuous Analysis of Gas Mixtures and its Application to the Measurement of the Velocity of Gas Currents. ADOLF KOEPSEL (*Ber. Deut. physikal. Ges.*, 1909, 237—242. Compare this vol., ii, 89).—In reference to the author's previous observation that the cooling effect exerted by a gas surrounding an electrically heated wire appears to attain a maximum value when a certain temperature is reached, it has now been found that the apparent maximum is due to a change in the heated nickel wire. New observations with silver wires do not exhibit the effect at all, the cooling produced increasing continuously as the temperature rises.

Experiments with platinum wires and a mixture of air and 5% of hydrogen show that explosion takes place when the temperature exceeds about 250°. In the case of mixtures of methane and air there is no explosive effect, but the methane undergoes combustion at temperatures below 400°. This is accompanied by a very considerable rise of temperature of the enclosed platinum wire. In the case of nickel wires no such effect is observed for temperatures up to 750°. H. M. D.

The Centrifuge in Quantitative Analysis. HARRY G. PARKER (*J. Amer. Chem. Soc.*, 1909, **31**, 549—551).—The apparatus consists essentially of a flask (that is, a flask-shaped tube open at both ends) 14 cm. long, with a diameter at the widest part of 3·5 cm.; this flask, holding about 75 c.c., is called the precipitation flask, as the solution to be analysed is precipitated in it by a suitable reagent. The neck of the flask fits into a weighed platinum crucible by means of a firm, water-tight joint, made by a short section of rubber tubing, which is held between the outside of the neck and the inside of the crucible.

The flask with the crucible is then placed in the jacket of a specially constructed centrifuge, and the space between is filled with water; the hydrostatic pressure being the same inside and outside the flask, there is no tendency to leak. A few minutes rotation at a speed of 1500—1800 revolutions per minute causes the precipitate to collect in the crucible. The flask is removed from the jacket, the water is drawn off by means of an ordinary siphon bottle, and the precipitate is washed three times with a very little water, each time repeating the process. Finally, the crucible is detached from the flask, dried, ignited, if necessary, and weighed. The chief advantage of the method appears to lie in the fact that no filter-paper is used. L. DE K.

Preparation and Use of Asbestos for Gooch Crucibles. PHILIP A. KOBER (*Amer. Chem. J.*, 1909, **41**, 430—432).—The asbestos is first purified by digestion with nitro-hydrochloric acid for several hours, it is then washed on a Buchner funnel, transferred to a bottle with sufficient water to make a good emulsion (2—10 grams per litre), a strong current of air passed through it for some time, and finally any large fibres remaining are got rid of by filtering through a Buchner funnel. Pulp thus prepared and diluted to about 0·1% can be used to give a layer of asbestos of any desired weight in a crucible.

G. S.

Preservation of Filter-paper; its Influence on Certain Estimations. Lucien L. de Koninck (*Bull. Soc. chim. Belg.*, 1909, 23, 221—222).—Mallinckrodt and Stull (*J. Amer. Chem., Soc.*, 1904, 26, 1029) called attention to the danger of using filter-paper unduly exposed to laboratory fumes. In the author's laboratory this fact has been confirmed by Lejeune. In the case of a nickel estimation based on the amount of chlorine evolved by heating the precipitated hydrated oxide with hydrochloric acid, the results were in excess of the truth when filter-paper was used instead of asbestos. It was then shown that this was due to the filter-paper. Mallinckrodt and Stull consider it probable that this had absorbed nitric compounds. The author, however, expresses an opinion that even pure air may be the cause of this, as a combination may take place between the nitrogen and oxygen under the influence of moisture and the porosity of the paper. L. de K.

Automatic Pipette for Sodium Hydroxide Solution. Francis G. Benedict (*J. Amer. Chem. Soc.*, 1909, 31, 652—654).—An arrangement is described by means of which a definite volume of saturated sodium hydroxide solution can be automatically run off from a stock solution. A wide glass tube has a two-holed rubber stopper inserted in the base. In one of the holes is a glass tube leading to the reservoir of sodium hydroxide solution, and in the other a goose-neck tube, which serves as an overflow for the expelled liquid. A glass plunger works in the wide tube by means of an iron rod, cord, and pulley; attached to the iron rod is a lever which actuates the mechanism for cutting off the supply of solution from the reservoir. When the plunger is raised, the shut-off from the reservoir is simultaneously opened, and the solution is allowed to flow into the wide glass tube until it rises to a mark which can be arbitrarily adjusted. At that moment the weight is released; it descends into the liquid, simultaneously shuts off the supply, and displaces a definite amount of the solution through the overflow tube. T. S. P.

Iron-alum as a Standard in Titrations. Lucien L. de Koninck (*Bull. Soc. chim. Belg.*, 1909, 23, 222—224).—Iron-alum (crystallised ferric ammonium sulphate) is recommended for standardising purposes on account of its high equivalent, its great stability in air, and the ease with which it is purified. To obtain it in a fit state as a reagent, the commercial salt is dissolved in a little hot (not boiling) water, and 100 c.c. of *N*-sulphuric acid added for every 100 grams of the alum. Perfectly pure crystals are then gradually deposited, which are spread on filter-paper and put, whilst still slightly moist, in a stoppered bottle. When required, a portion of it is exposed to the air for some fifteen to twenty minutes until its weight is constant, when its iron content corresponds exactly with the salt with 24 mols. of water; 100 parts of the salt = 11·6 parts of metallic iron.

When exposed to the air for weeks or months, a white powder is formed containing 6 mols. of water. L. DE K.

Detection and Estimation of Chloride in Presence of Bromide and Estimation of Iodide, Bromide, and Chloride in Mixed Solution. ROBERT M. CAVEN (*J. Soc. Chem. Ind.*, 1909, 28, 505—508).—Chlorides may be detected in presence of bromides by boiling the solution, which should be concentrated to a small volume with 10—15 c.c. of dilute nitric acid (1 vol. of acid, D 1·42; 3 vols. of water), until the bromine has been expelled and the liquid has turned colourless. The solution is then tested for chlorine as usual. The process may be rendered quantitative by heating in a flask at 80° in a current of air, then boiling for just one minute, and again passing a brisk current of air. No chlorine is then volatilised. Volhard's titration process is used. When the three halogens are present, the process may be summarised as follows. The total halides are estimated by Volhard's titration process. The iodine is titrated indirectly by estimating with standard dichromate the ferrous iron generated on boiling the solution with iron-alum. The chlorine is estimated after eliminating the iodine by means of hydrogen peroxide and acetic acid and boiling in a current of air; the bromine is then expelled by nitric acid as directed. The bromine is found by difference. L. DE K.

Detection of Chlorides in the Presence of Complex Cyanides and other Halogenides. WILHELM BÖTTGER (*Zeitsch. anal. Chem.*, 1909, 48, 356—368).—The process is briefly as follows. About 0·5 gram of the cyanogen compound which has to be tested for chlorine is mixed with 3 parts of mercuric oxide and boiled for a few minutes with 10 c.c. of 2*N*-sulphuric acid diluted with 20 c.c. of water. When cold, the mercury and other heavy metals are removed with hydrogen sulphide, the excess of which is then displaced by passing a rapid current of carbon dioxide. Before testing for chlorine, any ferrous iron must be oxidised to the ferric state, and this is done most conveniently with potassium permanganate, which reagent is also suitable for the elimination of any iodine or bromine present. L. DE K.

Analyses of Mixtures of Halogen Acids. WILLIAM M. DEHN (*J. Amer. Chem. Soc.*, 1909, 31, 525—529).—The process is intended for solutions of halogens in an alkali hydroxide. In the case of a bromine solution ("hypobromite"), the solution is titrated for *bromide* by adding *N*/10-silver nitrate until silver oxide begins to separate. Sodium hydrogen carbonate is now added until the colour of the precipitate turns white or light yellow (with bromides this addition is not essential), the liquid is poured off through a Gooch funnel, and the precipitate is washed by decantation. The precipitate both in the flask and the funnel is treated with dilute nitric acid to dissolve the excess of silver, which is then estimated by Volhard's thiocyanate method.

The *hypobromite* is estimated by boiling a known volume of the solution with ammonia until the excess of this has been expelled, or hydrogen peroxide may be added to the cold solution. A known volume of $N/10$-silver nitrate and some sodium hydrogen carbonate are then added, and the liquid is poured through an ordinary filter. The excess of silver in the precipitate is estimated as directed, and the loss incurred corresponds with the sum of the halide and hypohalite. The total bromine (including that in the state of bromate) is estimated by first reducing the hypobromite as directed, and the bromate is then reduced by means of finely divided metallic iron and a very slight excess of sulphuric acid. The solution is filtered, and treated with a known volume of $N/10$-silver nitrate. After fully oxidising the iron by boiling with nitric acid, the excess of silver is estimated as directed, and the difference represents the total bromine.

Solutions of chlorine and iodine in sodium hydroxide may be analysed in a similar manner, but in the case of iodine the addition of sodium hydrogen carbonate should be omitted.

L. de K.

Estimation of Iodine in Iodoform and Thymol Iodide. Eustace H. Gane and W. H. Webster (*Zeitsch. angew. Chem.*, 1909, 22, 1059—1061, 1190—1191).—*Iodoform.*—Utz's process (*Apoth. Zeit.*, 1903, 9/12) is preferred. 0·5 Gram of the sample is dissolved in 10 c.c. of a mixture of 1 part of ether and 2 parts of alcohol. Fifty c.c. of $N/10$ silver nitrate and then 1 c.c. of cold fuming nitric acid are added, and the whole is heated on the water-bath until the odour of nitrous acid has disappeared. One hundred c.c. of water are then added, and the excess of silver is titrated with thiocyanate, using ferric alum as indicator. A second method is based on saponifying the iodoform by prolonged boiling with strong alcoholic potassium hydroxide and finally titrating the potassium iodide formed after neutralising the alkali with nitric acid, but is less practical.

Thymol Iodide.—The authors have worked out the following process. One gram of the sample is mixed with 1 gram of potassium sodium tartrate and 5 grams of dry sodium carbonate, placed in a deep porcelain crucible, and the solid mass is then covered with another portion of the soda mixture. The crucible is covered and the contents gradually heated to fusion for forty-five minutes. The mass is extracted with water, and a third part of the filtrate is carefully neutralised with 5% nitric acid, using methyl-orange test-paper as indicator. After adding a pinch of calcium carbonate, the iodine is titrated with $N/10$-silver nitrate, using potassium chromate as indicator. The liquid is now acidified with nitric acid, and the silver iodide collected and weighed as usual. Should it contain chloride, its weight will not correspond with the titration result, but the true amount of iodine and chlorine may then be found by a simple calculation. For the direct estimation of both chlorine and iodine, the first and second portions of the filtrate may be used, the usual methods being employed.

Detection of Inorganic Iodine.—Two grams of the sample are dissolved in 20 c.c. of carbon disulphide, and shaken with 100 c.c. of water for thirty minutes so as to dissolve any iodides present. Seventy-five c.c. of the aqueous solution are filtered, and again shaken twice with 15 c.c. of carbon disulphide to remove the last traces of thymol iodide. The iodine is then liberated with nitric acid, and extracted with carbon disulphide as usual.

Matter insoluble in ether is best estimated by treating 2 grams of the sample in a tared beaker with 10 c.c. of ether. After carefully decanting the ether, the residue is washed thrice in succession with further portions of 10 c.c. of ether, and then dried at 100°. L. DE K.

Fluorides in Wine. CARLO MENSIO (*Chem. Zentr.*, 1909, i, 1046; from *Staz. sperim. agrar. ital.*, 1908, 41, 819—832).—The following method is recommended for the detection of fluorides in wine. One hundred c.c. of the sample are mixed with 2—3 c.c. of 2*N*-sodium carbonate, and the liquid is heated and precipitated with calcium chloride. The washed precipitate is heated in a platinum dish with sulphuric acid; the dish is covered with a watch-glass which is coated with wax, only a small, bare spot being exposed to the fumes. The test shows the presence of as little as 0·009 gram of sodium fluoride; smaller quantities may be found by working on larger quantities of the sample. L. DE K.

Quantitative Nitrogen Analysis for Very Small Amounts. EILHARD A. MITSCHERLICH, PAUL HERZ, and ERNST MERRES (*Landw. Versuchs-Stat.*, 1909, 70, 405—411).—The apparatus for the first process consists of a 1-litre Kjeldahl flask provided with a Hugershoff distilling tube, which reaches to the bottom of a second 500 c.c. Kjeldahl flask. The substance is heated with 200 c.c. of water and 3 grams of Devarda's alloy, and 50 c.c. of concentrated sodium hydroxide solution in the larger flask, and most of the water distilled over into the second flask containing 60 c.c. of strong sulphuric acid and 20 c.c. of water. When the heating is discontinued, the acid solution rises in the tube and flows into the larger flask. The latter is again heated two or three times in order to rinse out the receiver, the condensed water being allowed to flow back each time. The Kjeldahl flask is then disconnected and heated until the conversion into ammonia is complete. It is again fitted with a distilling tube, which passes through the cork of a 200 c.c. Kjeldahl flask, reaching to the bottom. This flask is provided with a quartz-glass tube, which passes to the bottom of an Erlenmeyer flask containing a suitable amount of *N*/50 sulphuric acid and 50 c.c. of distilled water. The Kjeldahl residue is dissolved in water, sodium hydroxide added, and distilled as usual for twenty minutes. The acid is titrated with *N*/50 alkali, free from carbonate, Congo-red being used as indicator.

Results obtained by the method showed that the error need not be more than ± 0·000020 gram N. N. H. J. M.

Estimation of Ammonia without a Condenser. R. O. E. Davis (*J. Amer. Chem. Soc.*, 1909, 31, 556—558).—A slight modification of Kober's process (Abstr., 1908, ii, 776) for urine, so as to render it fit for the estimation of nitrogen in cotton-seed meal.

The heat developed by the neutralisation of the acid in the Kjeldahl flask by the alkali drawn into it by suction from another bottle is not lasting enough, but if the flask is placed in an asbestos box it keeps warm for an hour and a-half, and the ammonia may thus be expelled fully by the air current. The best plan is to absorb the ammonia in a Folin tube supplemented with a tube filled with glass beads moistened with acid. The expulsion of the ammonia from the Kjeldahl flask may be facilitated by adding scrap aluminium, which gives off hydrogen. In the case of cotton-seed meal, 0·5 gram is digested with 30 c.c. of sulphuric acid; a little aluminium may be added instead of the usual globule of mercury. Before neutralisation, 100 c.c. of water are added, and the alkali introduced develops enough heat to make the solution boil. An illustration showing the complete apparatus is given. L. de K.

Apparatus for the Estimation of Ammonia. Henri Vigreux (*Bull. Soc. chim.*, 1909, [iv], 5, 574—577).—The author has applied his special form of condenser tube (Abstr., 1908, ii, 938) to the apparatus for the Kjeldahl estimation. Such a tube rises vertically from the flask, and therefore the distillation is really a fractional one, the ammonia passing over with the minimum amount of water. There is no danger of loss of acid from the receiver, as the condensing tube to which the vertical tube is in turn connected by a double right-angled bend is long enough to prevent its getting into the distilling flask should any sudden regurgitation take place. L. de K.

Gravimetric Estimation of Nitric Acid. Max Busch (*Zeitsch. anal. Chem.*, 1909, 48, 368—370).—A reply to Hes (this vol., ii, 265). The use of dried filters is open to objection. As regards the concentration, the author insists that 10—12 c.c. of 10% nitron acetate solution should be added to 80—100 c.c. of the liquid under examination; Hes uses only 5 c.c. to 250 c.c., finally to 750—1000 c.c., and this may be the reason why he did not get satisfactory results in the estimation of nitrates in waters by the nitron method. L. de K.

Busch's Nitron Process. Peter Pooth (*Zeitsch. anal. Chem.*, 1909, 48, 375—376).—The author advises the preparation of only a small quantity of "nitron" solution at a time, and that this should be kept in the dark. The influence of hydrochloric acid on the precipitation has been studied, and it is found that for every 0·1 gram of a nitrate the hydrochloric acid should not exceed 100 c.c. normal solution. L. de K.

Estimation of Nitrates by Grandval and Lajoux's Method. L. Farcy (*Bull. Soc. chim.*, 1909, [iv], 5, 562—563).—A reply to Lombard and Lafore (this vol., ii, 436). The author agrees that nitro-hydrochloric acid is formed in the reaction (see following abstract). L. de K.

Influence of Bromides and Iodides on the Estimation of Nitrates in Waters. L. Farcy (*Bull. Soc. chim.*, 1909, [iv], 5, 563—566).—The author has continued his experiments (this vol., ii, 344), and investigated the influence of bromides and iodides on the estimation of nitrates in water by Grandval and Lajoux's colorimetric process. The following conclusions are arrived at: The halogen salts exercise a disturbing influence. The coefficient of decolorisation is different according to the salt present (the action of the iodide is intermediate between that of the chloride and bromide). The mechanism of the reaction is most likely the same for the three classes of halogen derivatives. It seems to be rather complex, and the investigation is being continued.

Tables are given, also a curve, by the aid of which the true amount of nitrate may be deduced if the quantities of halogens are known.

L. de K.

Detection of Phosphorus by means of the Photographic Plate. Luigi Sabbatani (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 468—475).—The detection of phosphorus in blood, tissue, etc., can be effected conveniently by means of an ordinary silver bromide plate. Either of two methods may be employed: (1) In a dark room, a drop of the liquid or a piece of the tissue is placed on the plate, which, after ten minutes, is washed under a water tap, developed, and fixed in the ordinary way. Should there be phosphorus in the liquid or tissue, a brown or black spot will appear on the plate, the depth depending on the amount of the phosphorus. By this method a few hundred-thousandths of a mg. of phosphorus are rendered evident. (2) About 10 c.c. or 10 grams of the material to be examined, well shredded if solid, is placed in a small, cylindrical beaker with a flat, ground edge, on which rests the plate with the emulsion downwards. After an hour, the plate is washed, developed, and fixed as usual. The action of phosphorus vapour on the plate is favoured by the presence of water vapour and by a rather high temperature of the material and a rather low one of the plate.

The presence of small quantities of phosphorus in the air expired by a poisoned animal or in the surrounding air may be detected by allowing a jet of the air to impinge on a part of the photographic plate arranged in a suitable case.

Other substances which influence a sensitive plate similarly, and are of biochemical importance, are hydrogen sulphide and hydrogen peroxide. The sensitiveness of the plate to these three substances in aqueous solution at the ordinary temperature is of the same order when the aqueous solutions are placed in contact with the plate, but is very much less for hydrogen peroxide vapour than for hydrogen sulphide or phosphorus vapour. If hydrogen sulphide is present, a few drops of lead acetate solution are added before testing for phosphorus, whilst the influence of hydrogen peroxide is avoided by allowing the vapour to act on the plate as described above. T. H. P.

Microchemical Method for Phosphorus in Plants. Corrado Bongiovanni (*Atti R. Istituto Veneto Sci., Lett. Arti.*, 1907–8, 67, 679—685. Compare this vol., ii, 512).—The method of Lilienfeld and

Monti (Abstr., 1893, ii, 135), modified by Pollacci (*Malpighia*, 1894, 8, 361), is unsuitable for the detection of phosphorus (compare Raciborski and Arcangeli, *Bot. Zeit.*, 1893, 145; Macallum, Abstr., 1899, ii, 232). N. H. J. M.

Method for the Estimation of Phosphoric Acid in Urine and in Alkali Phosphate Solutions. PAUL VON LIEBERMANN (*Biochem. Zeitsch.*, 1909, 18, 44—57).—The method is similar to Volhard's estimation of halides. The phosphoric acid is precipitated by the addition of a known quantity of standard silver nitrate solution, and the excess of silver in the filtrate estimated by titration with alkali thiocyanate. In the case of urine, it is necessary to first precipitate the phosphates by means of magnesia mixture, and then wash in order to remove other substances which yield precipitates with silver salts.

Full details for using the method in the case of urine are given. With an alkali phosphate solution the following procedure is recommended.

A given volume of the solution is treated with 12·5 c.c. of pure nitric acid (1·31) and diluted to 50 c.c., the silver nitrate is added, the solution neutralised with ammonia, diluted to a given volume, filtered, and the silver estimated in 100 c.c. of the filtrate. J. J. S.

Examination of Calcium Phosphate Food. OSKAR KELLNER (*Landw. Versuchs-Stat.*, 1909, 70, 471—480).—The following method is recommended. The finely powdered substance (2·5 grams) in a dry 400 c.c. flask is treated with 250 c.c. of Petermann's citrate solution, and shaken for half an hour in a rotatory apparatus. The solution is then passed through a dry filter into a dry vessel, and 50 c.c. of it (= 0·5 gram substance) treated with strong nitric acid (20 c.c.) and then with water (about 50 c.c.), and boiled for ten minutes. The phosphoric acid is then precipitated. N. H. J. M.

Mercury Seal in Place of Cork or Indiarubber for Connecting the Combustion Tube with the Calcium Chloride Tube. J. MAREK (*J. pr. Chem.*, 1909, ii, 79, 510—512).—The author has simplified the mercury seal previously described by him (Abstr., 1907, ii, 909). The end of the combustion tube is drawn out and turned upwards at right angles. Over this narrow portion is fitted, by means of a cork, a wide glass tube containing mercury, which forms the seal. The side-tube of the calcium chloride tube is so modified that it fits over the narrow end of the combustion tube and dips under the mercury, thus forming an air-tight joint. T. S. P.

Apparatus for Estimating Hydrogen Given Off on Treating Metals with Acids. ÉMILE KOHN-ABREST (*Ann. Chim. anal.*, 1909, 14, 177—182).—The apparatus consists essentially of a generating flask in which the metal is attacked by hydrochloric acid (1 : 10), drying tubes, a combustion tube with copper oxide heated to redness, tubes intended for absorbing the water formed, and an apparatus to supply carbon dioxide to sweep out completely any traces of hydrogen and water vapour. For details, the illustrations of the rather complicated arrangement should be consulted. L. DE K.

Direct Estimation of Two Co-existent Substances Without Separation. ATH. J. SOFIANOPOULOS (*Bull. Soc. chim.*, 1909, [iv], 5, 632—641).—This depends on the principle that if a known weight of a mixture of salts of two metals with the same acid is wholly converted into a mixture of the salts of a second acid and the product is weighed, it is possible to calculate the composition of the original mixture. In the first part of the paper the method of obtaining the two equations necessary for this calculation is given, and in the second part the possibility of extending this method to mixtures of more than two substances is discussed. As a concrete illustration, the analysis of a Greek pyrolusite is quoted. After separating silica as usual, two-thirds of the filtrate, containing the matter soluble in hydrochloric acid, is treated with ammonia, ammonium chloride, and bromine in the usual way, and the mixed precipitate collected, dried, treated with nitric acid, ignited, and weighed as a mixture of ferric, aluminium, and manganese oxides. The mixture is then treated with hydrofluoric acid, and the mixed dry fluorides obtained weighed. A definite portion of the original filtrate is next boiled with excess of zinc oxide, and the manganese in it estimated by titration with potassium permanganate. From the three figures thus obtained, the relative proportions of manganese, iron, and aluminium in the precipitate can be calculated. The compounds most suitable for this method of working are the fluorides, silicofluorides, and oxides obtained by ignition of nitrates.

T. A. H.

Estimation of Potassium in Soils. P. DE SORNAY (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 26, 976—978).—A slight modification of Ronnet's process (Abstr., 1908, ii, 534). An aliquot part of the nitric acid extract of the soil (representing 20 grams of material) is evaporated with addition of a few drops of barium nitrate, and the residue is ignited for about five minutes in order to decompose the nitrates formed. The mass is then mixed with 12 to 15 grams of oxalic acid and a little water, precautions being taken against spirting. The whole is then evaporated to dryness and again calcined, so as to convert the calcium and magnesium into carbonates. Iron and aluminium remain as oxides. The residue is now boiled with water, of which 30 to 40 c.c. suffice for a complete extraction of the potassium, which is then estimated as usual as platinichloride. L. DE K.

Estimation of Potassium in Soils as Phosphomolybdate. P. DE SORNAY (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 26, 978—980).—By adding to solutions of potassium chloride, nitrate, and sulphate of known potassium content a definite amount of phosphomolybdic acid, and estimating the phosphoric acid both in the precipitate and filtrate, the author has obtained results proving that the composition of potassium phosphomolybdate is not constant. L. DE K.

Double Fluorides of Sodium. W. A. R. WILKS (*Proc. Camb. Phil. Soc.*, 1909, 15, 76—77).—Experiments are described which show that sodium can be precipitated almost completely from solution in the form of a double fluoride with aluminium. To prepare the precipitant, excess of moist aluminium hydroxide is left for two days in contact with concentrated hydrofluoric acid. To diminish the concentration of the hydrogen ions, an equal bulk of a cold saturated solution of copper acetate is added to the hydrofluo-aluminic acid solution, which is then boiled and filtered. An equal volume of a 50% solution of ethyl alcohol is then added; this increases the sensitiveness of the reaction.

The solution to be tested for sodium is added to the hot reagent and boiled for some time. The test appears to be very delicate, one part of sodium chloride in 20,000 parts of water being readily detected. The precipitated substance has not the composition of cryolite; the atomic ratio of sodium to aluminium is 1·1 to 1. Potassium and ammonium are not precipitated by the reagent, but it yields insoluble compounds with solutions containing silver, magnesium, calcium, strontium, barium, and lead. H. M. D.

Assay of [Burnt] Magnesite. Merck Guano und Phosphat Werken. Aktien-Ges. (*Chem. Zeit.*, 1909, **33**, 545—546).—5·05 Grams of burnt magnesite are boiled with 150 c.c. of 2*N*-sulphuric acid until foaming sets in; some water is then added, and the boiling is repeated. When cold, the whole is diluted to 500 c.c.; 100 c.c. of the solution are mixed with 50 c.c. of 20% ammonium chloride solution, and the excess of acid is then titrated with *N*/2-sodium hydroxide, using methyl-orange as indicator. This gives the joint amount of the magnesium, calcium, iron, and aluminium oxides. Another 100 c.c. are placed in a 500 c.c. flask, the requisite amount of *N*/2-alkali is added, and then 25 c.c. of 2*N*-sodium hydroxide. After diluting to the mark and thorough shaking, the liquid is filtered after a-quarter of an hour; 100 c.c. of the filtrate are now titrated with *N*/10-sulphuric acid, with phenolphthalein as indicator. The sodium hydroxide consumed represents the joint amount of magnesium and iron-aluminium oxides. The two latter are estimated in the usual manner, by a double precipitation with ammonia, in one gram of the sample after removing the soluble silica by evaporation with hydrochloric acid as usual. The calculation is as follows: The magnesium oxide content is obtained by deducting the number of c.c. of sulphuric acid (second titration) from 100. For each 1% of joint iron and aluminium oxides, 0·7 c.c. should be deducted, and to the final result 0·2 must be added; each c.c. = 1% of magnesium oxide. The calcium oxide content is calculated from the two titrations. If the number of c.c. of alkali (first titration) is deducted from 120, the amount of *N*/2-sulphuric acid consumed is obtained. The difference between this number and the number of c.c. of alkali (second titration) reckoned as decinormal gives when multiplied by 1·385 the calcium oxide content.

Burnt magnesite contains a large proportion of its silica in the soluble condition, but in the crude mineral there seems to be no soluble silica. L. de K.

The Mercury Cathode. Wilhelm Böttger (*Ber.*, 1909, **42**, 1824—1839).—An improved method is described for performing electrolytic estimations with a mercury cathode, which requires less time and gives more concordant results than the usual methods. A fairly low current density (28 amperes per sq. dm.) is used, to avoid heating. At the end of the electrolysis, an excess of 2*N*-sodium acetate is added, the current disconnected, and the amalgam washed successively with water, alcohol, and ether. The adhering ether is removed as far as possible with filter paper, and finally by a current of dry air, led in by a capillary tube above the surface of the amalgam. No mercury is lost in this way. A helical rotating anode is used. Methyl alcohol may replace the alcohol and ether for washing. A large number of estimations of zinc are given to show the accuracy of the method. The addition of sodium acetate is shown not to cause deposition of sodium. The addition of ammonia to neutralise the acidity of the electrolyte, instead of sodium acetate, leads to loss of zinc, apparently owing to a formation of ammonium amalgam, which decomposes and emulsifies the amalgam. C. H. D.

Spectrographic Analysis of a Specimen of Commercial Thallium. James H. Pollok (*Sci. Proc. Roy. Dubl. Soc.*, 1909, 11, 338—344).—For the detection of the lines due to impurities a photograph was first taken with a pure specimen of the metal, using a long slit. The slit was then reduced to one-third of its original length, and a photograph of the commercial metal was superposed on the former. By this means the lines which are due to impurities are found in the short spectrum, and can be very quickly measured and identified. The impurities thus found in a sample of commercial thallium were lead, tin, copper, and aluminium. H. M. D.

Volumetric and Gravimetric Estimation of Thallium in Alkaline Solution by means of Potassium Ferricyanide. Philip E. Browning and Howard E. Palmer (*Zeitsch. anorg. Chem.*, 1909, 62, 218—220 *).—The method previously described for the estimation of cerium (Abstr., 1908, ii, 736) is also applicable to thallium. Excess of potassium ferricyanide is added to a solution of a thallous salt, followed by potassium hydroxide. The brown thallic hydroxide is filtered through asbestos and washed. The filtrate is acidified with sulphuric acids, and titrated with potassium permanganate:

$$Tl_2O + 4K_3Fe(CN)_6 + 4KOH = Tl_2O_3 + 4K_4Fe(CN)_6 + 2H_2O.$$

$$5K_4Fe(CN)_6 + KMnO_4 + 4H_2SO_4 = 5K_3Fe(CN)_6 + 3K_2SO_4 + MnSO_4 + 4H_2O.$$

A small correction has to be made for the amount of permanganate required to produce a visible coloration.

The same method may be employed gravimetrically, the precipitated thallic hydroxide being washed with hot water and dried at 200°. Both methods give accurate results. C. H. D.

Volumetric Method for the Estimation of Cerium in the Presence of other Rare Earths. Floyd J. Metzger (*J. Amer. Chem. Soc.*, 1909, 31, 523—525).—Fifty c.c. of the nitrate solution are evaporated with 20 c.c. of sulphuric acid until sulphuric fumes appear. When cold, 2 grams of ammonium sulphate are added, and the whole is diluted with 80 c.c. of water. One gram of sodium bismuthate is added, and the mixture heated to boiling; this converts the cerium into ceric sulphate. After cooling slightly, 50 c.c. of 2% sulphuric acid are added, the solution is filtered, and the filter washed with 100—150 c.c. of the same acid. Standard ferrous ammonium sulphate is added until the colour has changed from yellow to colourless, in order to reduce the salt to the cerous state, and the excess of iron is then titrated with permanganate. The value of the permanganate in terms of iron × 3·08415 = cerium dioxide. L. DE K.

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* and *Amer. J. Sci.*, 1909, [iv], 27, 379—380.

Separation of Chromium, Iron, Aluminium, and Zinc in a Mixture. M. EMMANUEL POZZI-ESCOT (*Bull. Soc. chim.*, 1909, [iv], 5, 558—559).—*Estimation of Iron.*—To the boiling solution is added an excess of sodium hypobromite (containing a large excess of alkali), and the boiling is continued for ten minutes. The precipitate is freed from aluminium and zinc by redissolving in hydrochloric acid and reprecipitating with excess of potassium hydroxide. The iron precipitate is then once more redissolved in hydrochloric acid and reprecipitated with ammonia as usual.

Estimation of Aluminium.—The alkaline liquid containing aluminium, chromium, and zinc is acidified with hydrochloric acid and boiled to expel the bromine. The aluminium is then precipitated at the boiling point with ammonia.

Estimation of the Chromium.—The filtrate from the aluminium is acidified with hydrochloric acid, and the chromic acid is reduced by boiling with alcohol; the chromium is then precipitated with excess of ammonia.

Estimation of Zinc.—The filtrate from the chromium is precipitated with ammonium sulphide, and the zinc sulphide treated as usual.

L. DE K.

Copper as a Reducing Agent for Ferric Salts previous to their Estimation Volumetrically. W. COLET BIRCH (*Chem. News*, 1909, 99, 273—275).—The author confirms the experiments of Storch (Abstr., 1893, ii, 468), who obtained satisfactory results by reducing the ferric iron with metallic copper in sulphuric acid solution, and has extended the process to hydrochloric acid solutions. The analysis is briefly as follows:

Twenty-five to thirty pieces of pure clean sheet copper, 2 by 2½ cm., and bent at right angles in the middle, are placed in a round-bottomed flask, the acid iron solution is added, and the whole boiled gently for at least five minutes. The liquid is then poured off, the copper rinsed a few times with air-free water, and the liquid titrated with potassium dichromate solution in the usual way, a solution of potassium ferricyanide in dilute sulphuric acid serving as indicator. The dichromate must be standardised by means of a definite quantity of iron oxide dissolved in hydrochloric acid previously reduced by copper as described. L. DE K.

Estimation of Nickel in Presence of Cobalt. JEAN A. SANCHEZ (*Bull. Soc. chim.*, 1909, [iv], 5, 641—647).—The process depends on the fact that if excess of potassium cyanide is added to a solution containing nickel and cobalt, the latter is converted into potassium cobaltocyanide, which, if the solution is evaporated to dryness in air, changes to potassium cobalticyanide. On re-solution in water and addition of silver nitrate, in excess, the cobalt is precipitated as silver cobalticyanide and the nickel is left in solution as the nitrate, and can be estimated, the excess of silver being first removed by adding potassium bromide. To the filtrate, sodium hydroxide and bromine are then added, and the hydrated nickel sesquioxide ignited and weighed. As an alternative, the hydrated sesquioxide may be transferred to a flask containing a solution of potassium iodide acidified with sulphuric acid, when the action represented by the following equation takes place: $Ni_2O_3 + 2KI + H_2SO_4 = K_2SO_4 + 2NiO + I_2$. The iodine liberated may be estimated by means of sodium thiosulphate.

If it is desired to determine cobalt as well as nickel, the mixed oxides are precipitated in the usual way with sodium hydroxide and bromine water, and weighed. This mixture is then treated as described above for the estimation of nickel, and the cobalt obtained by difference. Full details of the methods of manipulation, quantities to be used, and precautions to be taken are given in the original. T. A. H.

Assay of Antimony Alloys. Paul Nicolardot and Krell (*Bull. Soc. chim.*, 1909, [iv], 5, 559—562).—The process is based on Deville's nitrate method (*J. Pharm. Chim.*, 1855). The alloy is attacked with nitric acid (D 1·2) and, after evaporation on the water-bath, the residue is heated for some time at 125° or a little above, and the mass is then taken up with water acidified with nitric acid. Tin and antimony remain as insoluble oxides, which are collected at the pump in a small, cylindrical tube, and finally reduced in a current of hydrogen at 400°. The metal obtained is tested quantitatively for tin and antimony by the ordinary methods. Tin may be weighed as oxide, but not the antimony, its oxide being of a somewhat variable composition.

Lead is estimated as usual in the nitric acid solution. Copper in bronzes is best deposited electrolytically from a nitric acid solution; the tin and antimony oxides should not be removed. L. de K.

Analysis of Tantalum Ores. Edward S. Simpson (*Chem. News*, 1909, 99, 243—244).—A reply to Giles, who objects to fusion with alkali hydroxide (this vol., ii, 352). Potassium hydroxide is the most suitable substance for opening up the tantalum ores, using 6 parts to 1 part of finely powdered sample. Nickel, or in some cases silver, crucibles may be used, covered with a lid slightly convex on the underside; the fusion is continued for fifteen to sixty minutes.

In order to prevent creeping of the alkali during fusion, a small sheet of asbestos millboard is taken, and in it is cut a circular hole of such a size that when the crucible is pressed tightly into it the bottom only projects a quarter of an inch. By means of a bunsen burner the lower part of the crucible is thus heated to redness, whilst the upper part remains comparatively cold.

It appears that when a dilute solution of mixed potassium tantalate, niobate, and titanate is slightly acidified with hydrochloric acid, only a portion of the niobium is precipitated as hydroxide, the remainder being present in the form of a soluble double chloride of titanium and neobium. L. DE K.

Detection of Wood Spirit in Galenical Tinctures. HENRI CARETTE (*J. Pharm. Chim.*, 1909, [vi], **29**, 481—484).—Gay's test, which depends on the formation of nitrogen iodide when ammonia is added to a solution of iodine in presence of acetone (which always occurs in wood spirit of commerce), is modified with a view to increasing its delicacy.

Ten c.c. of the tincture are distilled, and 5 c.c. of distillate collected. To this are added 5 c.c. of water, 5 c.c. of ammonia (D 0·930), and 1 c.c. of tincture of iodine (Codex Français, 1884). The mixture is shaken during fifteen minutes, and exposed to diffused daylight. A black precipitate of nitrogen iodide is formed on adding the iodine solution, and if acetone is present, on remaining at 18° in the light, this precipitate gradually changes into iodoform. If very little acetone is present, the tube should be warmed at 55° until the precipitate disappears, and then the liquid shaken with ether. The latter dissolves out the iodoform, which can be recovered by allowing the solvent to evaporate. In the absence of acetone, the nitrogen iodide persists in daylight for at least twelve hours at 18°, but only for about fifteen minutes at 65°. T. A. H.

Schmitt's Process for the Estimation of the Total Esters in Wine. FRANCESCO SCURTI and G. DE PLATO (*Chem. Zentr.*, 1909, i, 1045—1046; from *Staz. sperim. agrar. ital.*, 1908, **41**, 681—688).—A solution is prepared containing the same amount of dextrose, lævulose, and oenotannin as the sample to be tested, and its neutralising power when boiled with alcoholic potassium hydroxide is ascertained. The alkali absorbed is then deducted from the amount of alkali neutralised on saponification of the sample, and the result, after allowing for the acidity of the wine, represents the esters. One c.c. of $N/10$-potassium hydroxide = 0·010275 gram of esters calculated as diethyl tartrate. A number of results are given in a table.

L. DE K.

Estimation of Essences in Liqueurs. L. VANDAM (*Ann. Chim. anal.*, 1909, **14**, 174—179).—One hundred c.c. of the sample are placed in a distilling flask, a little fine pumice stone is added, and 70 c.c. are collected in a 100 c.c. receiver. After taking the alcoholic strength, the liquid is diluted with a calculated amount of water and alcohol in such a manner that there shall be exactly 100 c.c. of alcohol of 50°. If the solution is still turbid at 17—18°, it must be diluted with an equal volume of alcohol (of 50°). It contains all the essence present in the sample.

Twenty-five c.c. of the solution, are placed in a test-tube, and water is added from a burette until a permanent turbidity is noticed (temp. from 16° to 18°). Reference is then made to empirical tables constructed for various kinds of essences. L. DE K.

A General Reagent for Phenols. Jean Pougnet (*Chem. Zentr.*, 1909, i, 1508; from *Bull. Sci. Pharm.*, 1909, 16, 142—145).—The reagent consists of 20 drops of 40% formaldehyde per 10 c.c. of water, to which before use an equal volume of sulphuric acid is added. On adding this to phenols or substances containing at least one phenolic group, characteristic precipitates or colorations are obtained. The test is applied as follows: about 0·02 gram of the substance is placed in a test-tube, 1 c.c. of the reagent is added, and then 1 c.c. of sulphuric acid. If the substance is a liquid, 1 c.c. is mixed with 1 c.c. of sulphuric acid, and 2 drops of formaldehyde are added. The author has tried the test with thirty-four substances. The reagent, in which the formaldehyde had been replaced by acetaldehyde, paraldehyde, anisaldehyde, acetone, and benzaldehyde, was also tried with resorcinol and morphine.

L. de K.

Methylglyoxal as a General Colour Reagent in Analysis. Georges Denigès (*Bull. Soc. chim.*, 1909, [iv], 5, 649—651).—Methylglyoxal is found to give characteristic colour reactions with many phenols, alkaloids, etc., and consequently it is proposed to employ it as a general reagent. The solution used is prepared by adding to 20 c.c. of a 5% aqueous solution of glycerol, 100 c.c. of water and 0·6 c.c. of bromine, and, after the halogen has dissolved, heating the solution during twenty minutes at 100°. It is then concentrated to 100 c.c., 20 c.c. of sulphuric acid added, and 50 c.c. of distillate, which is to be used as the reagent, collected.

This in presence of sulphuric acid gives the following colorations with the substances named: pyrogallol (brown), resorcinol (orange), catechol (red), *apo*morphine (violet-red), morphine (yellow to yellowish-brown), codeine (yellow, changing to green). In presence of sulphuric and acetic acids it gives the following reactions with the substances named: indole (strawberry-red), scatole (orange), pyrrole (brown). With potassium bromide and sulphuric acid the following colours are obtained: phenol (carmine-red, changing to orange), salicylic acid (violet), gallic acid (blue, changing to violet), benzene homologues (red), naphthalene (green), santonin (reddish-violet, changing to blue, and finally to green), and thiophen (red, changing to violet and blue). Traces of thiophen may be detected in benzene by this reagent.

Slight variations in applying the test are necessary in some cases, and these are given in detail in the original. Glyoxal gives reactions of a similar kind, but is less easy to use.

T. A. H.

Detection of Inositol in Natural Wines. G. Perrin (*Ann. Chim. anal.*, 1909, 14, 182—183).—Two hundred c.c. of the sample are mixed with 20 c.c. of basic lead acetate and a few drops of alcoholic tannic acid. The filtrate is freed from lead by means of hydrogen sulphide, and after decolorising the filtrate with animal charcoal, if necessary, the colourless liquid is evaporated in a porcelain dish on the water-bath until 10—20 c.c. of a syrupy mass are left. Two drops of this are placed on a platinum foil with a drop of 10% silver nitrate solution, and the whole is evaporated and heated until the mass is carbonised;

on further incineration, a fine rose coloration, slightly violet, is noticed, which disappears on cooling, but returns on heating. L. DE K.

Seliwanoff's Reaction. WILLIAM OECHSNER DE CONINCK (*Bull. Soc. chim.*, 1909, [iv], 5, 569).—A reply to Pieraerts (this vol., ii, 272). The author states that the colorations obtained by heating with hydrochloric acid certain urines to which resorcinol has been added, are not characteristic of diabetes. These colorations, as far as diabetic urines are concerned, may be due to dextrose as well as lævulose. The Seliwanoff-Borchardt test is not at all an absolute one, and is no criterion of true lævulosuria. L. DE K.

Analysis of Galactose. ALBERT FERNAU (*Zeitsch. physiol. Chem.*, 1909, 60, 284—288).—The following modification of Tollens' method is recommended: 60 c.c. of nitric acid (1·15) are poured into 5 grams of galactose in a 150 c.c. beaker, and the mixture evaporated to 15—16 c.c. on a water-bath. When cold, 40 c.c. of water are added, and the mixture left for twelve hours at the ordinary temperature. The precipitate of mucic acid is then removed to a Gooch crucible, washed with 50 c.c. of water, dried in a steam-oven, and weighed. By this method, pure galactose invariably yields more than 70% of mucic acid. If smaller amounts of water are used, other acids are retained by the mucic acid and affect the result.

Any specimen which gives 70% of mucic acid may be regarded as fairly pure. J. J. S.

Defecation of Milks for the Estimation of the Lactose by Copper Solutions. CYRILLE CARREZ (*Ann. Chim. anal.*, 1909, 14, 187—188).—When dealing with human milk, most of the defecation reagents are unsuitable. The following process, however, gives satisfactory results: In a 100 c.c. flask are introduced the following substances in the order indicated; after each addition the contents are well mixed. Milk, 10 c.c.; water, 40—60 c.c.; ferrocyanide solution (150 grams per litre), 2 c.c.; zinc acetate solution (300 grams per litre), 2 c.c.; phenolphthalein (1% solution), 1 drop; aqueous sodium hydroxide, a sufficiency to get a slight coloration; water, up to mark. The filtrate, which represents the milk ten times diluted, may then be titrated with alkaline copper solution for lactose as usual. The method is, of course, also applicable to milks from other sources.

L. DE K.

The Estimation of Mannose, Arabinose, Xylose, and Hydrolysed Milk Sugar. REGINALD O. HERZOG and F. HÖRTH (*Zeitsch. physiol. Chem.*, 1909, 60, 152—154).—Tables are given showing the amount of cuprous oxide produced by different quantities of the sugars when treated with Fehling's solution according to Kjeldahl's method. S. B. S.

New Method of Estimating Starch in Grains and Meal. L. M. LJALIN (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 472—476).—The refraction of a starch solution is not altered by saccharifying the starch, so that, in the estimation of starch by the refractometer, it is only necessary to effect complete liquefaction of the starch. Experiments with starches of various sources show that 1 gram of starch per 100 c.c. of solution corresponds with four scale-divisions of the Zeiss immersion refractometer. The diastase used by the author is precipitated from an aqueous infusion of a well-grown malt rich in protein by addition of ammonium sulphate, the method of estimation being as follows.

Two to three grams of the finely-ground cereal is pounded in a mortar with a little water, and introduced quantitatively into a 100 c.c. flask, the volume being made up to about 80 c.c. 0·2 c.c. of a 1% diastase solution is then added, the flask heated for five minutes on a boiling water-bath, and subsequently cooled to the ordinary temperature. A further 0·2—0·3 c.c. of the 1% diastase solution is then added, and the flask kept at 55—60° for half an hour, the liquid being then cooled, made up to 100 c.c., well shaken, filtered, and examined in the refractometer at 17·5°. In order to correct for the refraction of the soluble substances in the cereal, 2 to 3 grams of the latter are pounded with water in a mortar, made up to 100 c.c., and filtered, the refraction of the filtrate being measured at 17·5°.

This method gives results in good agreement with those yielded by Lintner's polarimetric method (Abstr., 1908, ii, 1077). T. H. P.

Estimation of Starch [in Potatoes, etc.]. M. Buisson (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 26, 980—983).—5·41 Grams (the normal weight of the French saccharimeter) of the potato pulp are introduced into a 200 c.c. flask, and 100 c.c. of water and 25 c.c. of cold saturated picric acid solution are added. The whole is heated in a calcium chloride bath (115°) and boiled for forty-five minutes, counting from the time it starts boiling. The flask is removed from the bath and 80 c.c. of water are added, and when the whole has cooled down to 15°, water is added up to the mark. The filtrate, which should be perfectly clear and fluid, is then polarised as usual. For farinas the picric acid may be reduced to 15 c.c. and the time of boiling to thirty minutes. L. de K.

Reaction for Acetone. Bruno Bardach (*Chem. Zeit.*, 1909, 33, 570. Compare Abstr., 1908, ii, 332).—To 5 c.c. of the clear, nearly neutral solution to be tested are added 1 c.c. of a 3% solution of peptone, then Lugol's solution (made by dissolving 4 grams of iodine and 6 grams of potassium iodide in 100 c.c. of water) until the liquid turns dark reddish-brown, and finally 3 c.c. of ammonia. The liquid should remain dark brown for some ten minutes, and, if necessary, a little more iodine solution may be added. After an hour, the liquid is decanted from the precipitate formed, and the remaining portion is acidified with hydrochloric acid. If everything dissolves, there is no acetone present, but if a deposit remains, it is examined microscopically. It may be freed from any free iodine by a few drops of sodium thiosulphate, and if present in any quantity its characteristic appearance may be recognised by the naked eye. L. de K.

Detection of Free Mineral Acids in Wine and Vinegar. Luigi Medri (*Boll. Chim. Farm.*, 1909, 48, 331—337).—In place of decolorising wine or vinegar by means of animal charcoal before testing for mineral acids by methyl-violet, the author recommends dialysis of the liquid. The apparatus employed consists of a small beaker with widened upper part, the ledge serving as support for a capsule made from a parchment disk by turning the edge up. Water (50 c.c.) is placed in the lower part of the beaker, and the wine or vinegar (50 c.c.) into the capsule, which is pressed down into the water by the weight of the liquid in it. After an hour, 10 c.c. of the dialysate are removed and tested with 10—12 drops of a 0·1% solution of metanil-yellow; in presence of free mineral acid, the colour is changed to orange-yellow or red, according to the amount of the acid.

T. H. P.

Sensitive Reactions for Lactic and Glycollic Acids. Georges Denigès (*Bull. Soc. chim.*, 1909, [iv], 5, 647—649).—The reactions depend on the fact that lactic and glycollic acids, when warmed with sulphuric acid, yield acetaldehyde and formaldehyde respectively, and that these aldehydes can be recognised by one of their characteristic colour reactions.

In practice not more than 0·2 c.c. of a solution of lactic acid (up to 2% strength) is warmed with 2 c.c. of sulphuric acid (D 1·84) at 100° during two minutes. To the cold mixture a drop of an alcoholic solution of guaiacol or codeine is added, when with the former a rose-red tint is produced, and with the latter, an orange-red coloration.

A similar method is used for glycollic acid, but in this case a higher temperature is required. With the cold solution, codeine gives a yellow coloration changing to an intense violet. Guaiacol gives a violet coloration changing to brown on dilution with alcohol, and *p*-cresol, a green tint. In using the two latter phenols, the mixture of glycollic acid, sulphuric acid, and phenol is slightly diluted with acetic acid, and the whole heated together. T. A. H.

Detection of Benzoic Acid in Foodstuffs. Mlle. Anna Jonescu (*J. Pharm. Chim.*, 1909, [vi], 29, 523—525).—When a solution of ferric chloride is added to one of benzoic acid, followed by a few drops of hydrogen peroxide solution, the liquid assumes a yellow tint, which changes gradually to deep violet, due to the conversion of the benzoic acid into salicylic acid by the action of the peroxide. It is proposed to apply this test to the detection of benzoic acid, or its salts, in such foods as butter and milk, the benzoic acid being separated by steam distillation. The colour reaction is also given by "saccharin."

T. A. H.

Estimation of Uric Acid in Urine. Ferruccio Sicuriani (*Chem. Zentr.*, 1909, 1, 1782; from *Arch. Farm. sperim.*, 1909, 8, 55—62).—One hundred and fifty c.c. of the sample are heated, and 5 grams of ammonium chloride are added. After one hour and a-half, the precipitate is collected and washed with 96% alcohol. The precipitate is then dissolved on the filter with 50 c.c. of *N*/10-potassium hydroxide, and the filtrate plus the washings is boiled until no more ammonia is given off. When cold, the solution is titrated with *N*/10-sulphuric acid, using phenolphthalein as indicator. The number of c.c. of alkali consumed × 0·056 = the amount of uric acid per litre.

L. DE K.

Estimation of Fats in Pork and Other Products Containing Water. GUSTAVE PERRIER (*Bull. Soc. chim.*, 1909, [iv], 5, 569—571).—The process described avoids the difficulties experienced in extracting fat from moist products with ether, and secures that the fat as isolated will not have become oxidised or otherwise changed. Ten grams of the material are triturated thoroughly in a mortar with 3 or 4 grams of washed and dried sand, and to this mixture is gradually added from 20 to 25 grams of anhydrous sodium sulphate, and the whole mixed completely. After half an hour, the mixture is transferred to a paper thimble, and extracted in a Soxhlet or other apparatus in the usual manner with ether; the extraction occupies about two hours, and yields a limpid solution.

T. A. H.

A New Reaction Characteristic of Adrenaline. SIGMUND FRÄNKEL and RUDOLF ALLERS (*Biochem. Zeitsch.*, 1909, 18, 40—43).—Most of the chemical reactions of adrenaline are also given by related substances; the following new and sensitive one is not. Iodic acid or potassium iodate and dilute phosphoric acid are warmed with a solution of adrenaline, when a red coloration is produced, which is believed to be due to the formation of an iodo- or iodoso-compound of adrenaline.

W. D. H.

Detection of Adrenaline in Blood-serum. G. COMESATTI (*Chem. Zentr.*, 1909, 1, 1609; from *Berl. Klin. Woch.*, 1909, 46, 8).—Six c.c. of fresh blood-serum, transudation, exudation, or extracts of organs prepared with physiological sodium chloride solution are shaken and then centrifugalised with double the volume of a solution made by dissolving 10 grams of mercuric chloride in 200 c.c. 95% alcohol. After twelve to twenty-four hours a diffused red colour is visible in the supernatant liquid should adrenaline be present.

L. DE K.

Detection of Adrenaline. KURT BOAS (*Chem. Zentr.*, 1909, 1 1609; from *Zentr. Physiol.*, 1909, 22, 825—826).—The author having tried Comesatti's process (compare preceding abstract), obtained negative results, but on heating the mixture, the characteristic red coloration was obtained. In presence of a large excess of hydrochloric acid, adrenaline causes a violet coloration.

L. DE K.

General and Physical Chemistry.

Change in Refractive Index with Temperature. II. K. George Falk (*J. Amer. Chem. Soc.*, 1909, 31, 806—821).—In an earlier paper (this vol., ii, 197) an account was given of measurements of the refractive indices of several liquids for the *C*, *D*, *F*, and *G′* lines at temperatures varying from 15° to 75°. The work has now been extended, and the results obtained for the *D*-line are given by the following equations: *iso*Butyl acetate, $n_D/1{\cdot}40013 + t/2963{\cdot}17 = 1$; ethyl butyrate, $n_D/1{\cdot}40196 + t/2911{\cdot}77 = 1$; *iso*amyl acetate, $n_D/1{\cdot}40973 + t/3101{\cdot}40 = 1$; methyl hexyl ketone, $n_D/1{\cdot}42437 + t/3308{\cdot}23 = 1$; nitrobenzene, $n_D/1{\cdot}56146 + t/3339{\cdot}79 = 1$; methylaniline, $n_D/1{\cdot}58104 + t/3236{\cdot}85 = 1$; benzyl cyanide, $n_D/1{\cdot}53281 + t/3623{\cdot}00 = 1$; benzaldehyde, $n_D/1{\cdot}55439 + t/3404{\cdot}86 = 1$. The densities of these liquids at different temperatures and the dispersions at 10° and 80° are recorded.

The refractive indices are plotted as curves, which show that in each case the index is a linear function of the temperature. The refractive powers were calculated for temperatures from 10° to 80°; the expression $(n_2 - 1)/d$ gave decreasing values as the temperature increased, $(n^2 - 1)/(n^2 + 2)d$ gave increasing values, whilst $(n - 1)d$ gave increasing values in some cases and decreasing values in others.

It is shown that the molecular refractions, calculated by using Brühl's values for atomic refractions, gave results agreeing with the experimental values as well at high as at low temperatures.

An attempt was made to study the state of equilibrium between the two forms of tautomeric substances, such as acetylacetone and ethyl acetoacetate, by means of the refractive indices, but it was found that only qualitative results could be obtained. E. G.

Flame Spectra of Certain Metalloids. Charles de Watteville (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 279—285).—The solutions to be examined were sprayed into the gas or air supply of a Bunsen flame, which was photographed through a quartz spectrometer on Lumière plates or films.

Solutions of ammonia, ammonium nitrate, or nitric acid gave the same band spectrum, which was ascribed to ammonia by Eder and Valenta, but must be the spectrum of nitrogen itself. Phosphoric acid and ammonium phosphate give a regular spectrum of six groups of bands, which were noticed, among others, by Geuther in the arc spectrum of phosphorus, where they were the faintest bands present. Arsenic solutions give a spectrum of 15 lines and 4 groups of bands which is extremely similar to the alternating spark spectrum of arsenic, and is only seen in the hottest region of the flame. Antimony solutions or vapour of antimony pentachloride give a spectrum of forty-four known lines and a number of bands intermingled with the bands of the water vapour spectrum as described by Hartley.

The spectra described are all in the ultra-violet region beyond the range of the solar spectrum. R. J. C.

Ultra-red Line Spectra. II. Spectra of Thallium, Aluminium, Zinc, Cadmium, Magnesium, and Calcium. Friedrich Paschen (*Ann. Physik*, 1909, [iv], 29, 625—663. Compare this vol., ii, 3).—The author has investigated in detail the ultra-red spectrum of the above metals. The representation of the various lines by means of series formulæ is considered. H. M. D.

Influence of Pressure on the Absorption of Ultra-red Radiation by Gases. Eva von Bahr (*Ann. Physik*, 1909, [iv], 29, 780—796).—The dependence of the ultra-red absorption on the pressure has been investigated for a number of different gases. In the case of carbon dioxide, carbon monoxide, nitrous oxide, carbon disulphide, methane, ethylene, acetylene, ammonia, and water vapour, the absorption increases with the pressure. The change in the absorption as the pressure is increased to one atmosphere is in general the same whether the increased pressure is brought about by the introduction of a foreign gas or by increase in the density of the absorbing gas. At low pressures the absorption increases rapidly with the pressure, but the rate of increase soon falls off, and the absorption approximates to a constant maximum value. In the case of carbon disulphide this condition is reached at 400—500 mm., in that of nitrous oxide at about 760 mm. On the other hand, for methane and carbon monoxide, the absorption increases with the pressure even at five atmospheres.

For a given gas the change of absorption with pressure is in general the same for the different absorption bands. In certain cases, increase in the density of the absorbing gas results in a widening of certain absorption bands, a phenomenon which is not brought about by increase in the total pressure as the result of admixture with a foreign gas.

The behaviour of methyl and ethyl ether is quite different from that of the above-mentioned gases, in that the ultra-red absorption of these vapours is independent of the pressure between 1 and 760 mm.
H. M. D.

Absorption of Ethereal Oils in the Ultra-violet. Al. Pflüger (*Physikal. Zeitsch.*, 1909, 10, 406).—The ultra-violet absorption of a number of ethereal oils and synthetic organic substances has been examined. A mercury lamp was used as radiator, a thermopile as indicator, and the substances were examined in thin layers between quartz plates. The percentage absorption values for various lines are tabulated. H. M. D.

Phosphorescence at very low Temperatures. Henri Becquerel, Jean Becquerel, and H. Kamerlingh Onnes (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 76—88).—The authors have investigated the phosphorescence spectra of uranyl salts at the temperatures of liquid air and liquid hydrogen. The bands, which are characteristic of the uranyl salts at the ordinary temperature and undergo subdivision at the temperature of liquid air, are transformed into groups of much finer lines at the temperature of liquid hydrogen. At the same time the emission maxima are displaced towards the smaller wave-lengths. Since the displacement is relatively small when the temperature falls from that of liquid air to that of liquid hydrogen, it is possible that the bands approach asymptotically a limiting position as the temperature is lowered.

From a comparison of the frequencies of the low temperature bands, the conclusion is drawn that the difference between the frequencies of two successive homologous bands is practically constant, and this holds for all series of homologous bands of the same salt. For different uranyl salts the values of this constant differ but slightly from one another. In structure, the uranyl salt bands resemble the band spectra of gases. At the temperature of solid hydrogen, a strong magnetic field has no influence even on the narrow bands.

The collective observations indicate that the phosphorescence of the uranyl salts is quite different in character from that of other classes of phosphorescent substances, and in no way depends on the presence of traces of impurities. The transfer of electrons under the photo-electric influence of the absorbed light appears to be a process which is entirely confined to the uranium atom, or at least to the uranyl group.

H. M. D.

Anomalous Rotatory Dispersion. Leo Tschugaeff (*Ber.*, 1909, **42**, 2244—2247).—Anomalous rotatory dispersion in the neighbourhood of absorption bands has been observed by Cotton (*Ann. Chim. Phys.*, 1896, [vii], 8, 347). The author has investigated three coloured substances, *l*-menthyldixanthogenide, $S_2(CS{\cdot}O{\cdot}C_{10}H_{19})_2$, thioanhydride of *l*-menthyl hydrogen xanthate, $S(CS{\cdot}O{\cdot}C_{10}H_{19})_2$, and *l*-bornyldixanthogenide, $S_2(CS{\cdot}O{\cdot}C_{10}H_{17})_2$, in toluene solution. The rotatory power in each case rises with diminishing wave-length, reaches a maximum, and then falls rapidly, the last two substances even showing a reversal of sign. The maximum lies nearer to the red end of the spectrum the more orange the colour of the compound examined. The position of the maximum varies with the solvent, obeying Kundt's rule.

C. H. D.

Isodynamic Change Revealed by Magnetic Rotatory Power. Paul Th. Muller and M. Thouvenot (*Compt. rend.*, 1909, **149**, 32—34).—Magnetic rotatory power has been shown by Becquerel to be quantitatively related to refractivity, which has been of great use in revealing tautomerism. Measurements here described of the magnetic rotatory power of substances well known to exist in tautomeric forms show that this property is also a trustworthy criterion of tautomerism. Methyl cyanoacetate dissolved in methyl alcohol bas the magnetic rotatory power, $R=4{\cdot}371$, whereas its sodium derivative has $R=7{\cdot}312$ under like conditions. Ethyl acetoacetate and ethyl sodioacetoacetate in ethyl alcohol have $R=6{\cdot}580$ and $R=11{\cdot}25$ respectively. The difference, due to the substitution of sodium for hydrogen in these cases (2·94 and 4·67) being in excess of the normal difference on substituting sodium for hydrogen (between 1 and 2), is held to demonstrate the tautomeric difference in constitution between each sodium derivative and its parent substance.

On the other hand, methyl cyanoacetate or ethyl acetoacetate, whether as pure liquid or dissolved in alcohol, has practically the same magnetic rotatory power. R. J. C.

Electrochemistry of Light. VII. Wilder D. Bancroft (*J. Physical Chem.*, 1909, 13, 449—468. Compare this vol., ii, 454).—A paper dealing with the theory of solarisation, in which the views of Abney, Trivelli, and others are discussed at length. Abney's view that the substance forming the latent reversed image is a silver oxybromide of the general type $AgBr_xO_y$ is untenable, as hypobromous acid does not give satisfactory reversals even when the concentration is varied over fairly wide limits. The author's theory is based on the assumptions (1) that the action of light on a silver halide corresponds with that of a direct current (Grotthus), causing the silver halide to pass through all the possible stages; (2) a developer does not cause the silver halide to pass through all the possible stages, and reduces certain silver halogen solid solutions or subhalides faster than others which contain less halogen. Abney's statement that oxidising agents facilitate reversal is not strictly true. Experiments with potassium nitrite and potassium permanganate indicate that when no oxidising agent is used, the finished plate contains a more intense reversed image and a less intense normal silver image, and that the effect of depolarisers in causing a reduction to silver is diminished in the presence of an oxidising agent, so that the finished plate contains less of the normal silver image, and therefore gives a clearer reversed image.

The antagonistic effect of different lights and a number of other phenomena are also considered. G. S.

De-accelerating Action of Bromides in the Photographic Developers. Samuel E. Sheppard (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 43—44).—In opposition to Lüppo-Cramer's view that the influence of bromides in diminishing the velocity of development is to be attributed to a colloido-chemical process, the author points out that the reaction is reversible, and can be explained completely from the molecular-kinetic standpoint as a consequence of the diminution of the concentration of the silver ions which are formed from the silver bromide. H. M. D.

Photopolymerisation of Anthracene. Alfred Byk (*Zeitsch. physikal. Chem.*, 1909, 67, 64—77).—Weigert has recently stated (Abstr., 1908, ii, 748) that the author's electrochemical addition to the thermodynamic theory of photochemical processes (Abstr., 1908, ii, 339) is unnecessary, but it is now shown that this is not the case. In connexion with the experimental basis of the theory, it is shown that the molecular weight of anthracene in phenetole is approximately normal, and up to a concentration of 0·37 mol. per litre does not tend to increase with the concentration. G. S.

Quantitative Study of the Photochemical Reaction between Quinine and Chromic Acid. Robert Luther and George Shannon Forbes (*J. Amer. Chem. Soc.*, 1909, 31, 770—783).—A study of the reaction between chromic acid and quinine in light has been made by Goldberg (Abstr., 1906, ii, 514), whose results seemed to indicate that the velocity was dependent on the quantity of light absorbed by the chromic acid.

It has now been found, however, by means of monochromatic light, that the quinine is the substance which is sensitive to light, whilst the chromic acid only acts as an indifferent light filter, absorbing a part of the light and converting it into heat. Determinations of the initial velocities of the reactions induced in solutions by monochromatic light have been made, and the quantities of light absorbed by the quinine and chromic acid have been calculated from measurements of extinction coefficients. The concentrations of the reacting substances, the intensity of the incident light, and the wave-length of the light were varied, one at a time, in successive experiments. The apparatus is described with the aid of a diagram. The source of light was a uviol mercury vapour lamp, and a series of light filters were employed. It was found in preliminary experiments that the total reaction velocity was proportional to the concentration of the hydrogen ion. In order to make this velocity large enough for convenient measurement, sulphuric acid (2·7 mols. per litre) was added to the reaction mixtures.

It has been found that the photochemical reaction is exactly the difference between the total reaction and the spontaneous reaction of the same mixture in the dark, and that the combined effect of two rays is additive. The speed of the photochemical reaction is proportional to the quantity of light of given wave-length absorbed by the quinine alone unless the concentration of the chromic acid is very small. It is probable that the reaction takes place in two stages: (1) the formation of sensitised quinine with a velocity proportional only to the light absorption, and (2) a reaction, in the ordinary sense, between this product and chromic acid with a velocity proportional to the concentration of the chromic and sulphuric acids. Formulæ have been deduced from which the velocity can be calculated of the reaction produced by the incidence of known amounts of light of various wave-lengths on any mixture of quinine and chromic acid under the conditions of the investigation. The photochemical efficiency of a given amount of absolute light-energy decreases as the wave-length of maximum absorption is approached. The effect of varying the thickness of the layer has been studied, and it is found that for given light absorption the velocity induced is inversely proportional to the thickness. The relative effect of two rays of different wave-length depends entirely on the thickness of the layer. E. G.

Amount of Radium Present in Sea-water. A. S. Eve (*Phil. Mag.*, 1909, [vi], 18, 102—107).—The examination of six samples of sea-water from the North Atlantic indicates the average radium content to be 9×10^{-16} gram per gram of sea-water. This is about one-seventeenth of the value found by Joly.

In the course of the measurements, it was observed that radium emanation may be collected either over water or mercury without any appreciable difference in the results obtained. H. M. D.

Expulsion of Radio-active Matter in the Transformations of Radium. OTTO HAHN and LISE MEITNER (*Physikal. Zeitsch.*, 1909, 10, 422).—In reference to a recent publication of Russ and Makower (this vol., ii, 455), the authors point out that they have already explained certain observations as being due to the recoil of the atomic residues which result from the emission of α- and β-particles.

H. M. D.

α-Rays from Radium-*B*. HOWARD L. BRONSON (*Physikal. Zeitsch.*, 1909, 10, 393—395).—The author has examined the influence of the air-pressure on the ionisation due to the active deposit on a wire exposed to radium emanation. The ionisation values are proportional to the pressure between 3 and 76 cms. of mercury, and from this the author draws the conclusion that no α-particles with a range between 0 5 and 5 mm. are emitted by the active deposit. These observations contradict the conclusion drawn by Harvey (this vol., ii, 203) that small range α-particles are emitted by radium-*B*. H. M. D.

Condensation of Radium Emanation. A. LABORDE (*Compt. rend.*, 1909, 148, 1591—1593).—Rutherford and Soddy (Abstr., 1903, ii, 462) found that when radium emanation is condensed in a copper tube by means of liquid air, it became gaseous once more when the temperature rose to about −150°. The author has used tubes of different materials in order to see if this temperature varied with the material of the tube. The emanation was condensed in the tube, and then a current of dry air, free from carbon dioxide, drawn through it, the air being tested for emanation from time to time as the temperature of the tube rose. With tubes of copper, iron, tin, and silver, the temperature at which the emanation became gaseous was −153° to −155°, whereas, with glass and silvered glass, it was −177°. This difference in temperature is possibly due to the absorption of the emanation by the metals, and consequently the effects of cocoanut charcoal, meerschaum, platinum-black, and spongy platinum were studied. With these substances, spongy platinum excepted, the liberation of the emanation took place slowly, and not rapidly as in the case of the metal tubes, and was not complete in an hour even when the temperature was raised considerably.

The conclusion is drawn that the temperature at which radium emanation is condensed depends on the physical nature of the containing vessel. T. S. P.

Comparison of the α Rays Produced by Different Radio active Substances. MLLE. BLANQUIES (*Compt. rend.*, 1909, 148, 1753—1756).—If the α-particles emitted by different radio-active substances differ only in their velocity of projection, then, at one and the same distance from the end of their course, they should have the same properties, independent of the substance from which they are emitted. In order to test this, the author has made experiments with polonium, radium-*C*, and actinium-*B*. To obtain a homogeneous radiation, it was necessary to use an extremely thin layer of the radio active substance, since the velocity of particles emitted from the interior of a thick layer is diminished by passage through the layer. The polonium was deposited electrolytically on a sheet of metal, and the other two substances were obtained by exposing sheets of metal for some hours to the emanations from radium and actinium. The ionisations produced by these substances at different distances were then measured, and curves plotted, showing the relation between ionisation and distance. These curves, after making corrections for the unequal activities of the three substances, should be superposible. This was found to be the case for polonium and radium-*C*, but not for actinium, the rate of decrease of activity with distance being less for actinium than for the two other substances.

The explanation put forward is that the α-particles emitted by the three substances are identical, except in so far as their velocities of projection are concerned, but that the radiation from actinium-*B* is complex. Actinium-*B* is supposed to be transformed, with the emission of α-particles, into another substance with a very short period of decay, which also emits α-rays. T. S. P.

Radioactivity of Potassium Salts. ÉMILE HENRIOT and G. VAVON (*Compt. rend.*, 1909, **149**, 30—32. Compare Henriot, this vol., ii, 458).—The authors find it impossible to concentrate the radioactivity of potassium by fractional crystallisation of potassium chloride, or its precipitation by gaseous hydrogen chloride, or by repeated precipitations of barium sulphate in potassium sulphate solutions. The various products obtained differed in radioactivity by less than 1%.

The radiation, which must be assumed to come from the potassium atom, possesses the penetrative power of β-rays, and is deviable by a magnetic field (compare Campbell, Abstr., 1907, ii, 597). The authors show that the rays are deviated as a negative flux would be, and can produce ionisation after passing through a sheet of tinfoil. This is held to prove definitely that potassium emits β-rays. R. J. C.

[The Radioactivity of Pitchblende from St. Joachimsthal.] JOSEF ŠTĚP (*Oesterr. Zeitsch. Berg. Huttenwesen*, 1909, **57**, 155).—A description of the apparatus and calculations employed for estimating the radioactivity in the raw, intermediate, and final products of the St. Joachimsthal uranium factory. The author was led to conduct this research from the work of H. Mache and S. Meyer, who demonstrated that a larger yield of radium chloride might be obtained from a given quantity of pitchblende than Curie had obtained.

F. M. G. M.

Induced Activity on the High Sea. H. SIEVEKING (*Physikal. Zeitsch.*, 1909, **10**, 398—399).—The rate of decay of the induced activity collected on a negatively-charged wire exposed for two hours during a journey from Alexandria to Naples has been examined. The observed rate of decay agrees with that obtained for the disintegration products of radium, and no evidence of thorium activity was found. In the author's opinion, the radium emanation is carried by air currents from the land. H. M. D.

Ionisation in the Atmosphere. A. S. Eve (*Le Radium*, 1909, 6, 88).—The apparatus for this estimation is described, and the following results deduced. If the value of the charge of an ion be taken as $3{\cdot}4 \times 10^{-10}$ U E S, and if it be supposed that an ion carries a single elementary charge, the following numbers are indicated.

Series.	Number of + ions per cm.^{3}.	Number of − ions per cm.^{3}.	Relation.
1	37,570	34,300	1·09
2	19,900	10,100	1·99
3	22,320	16,820	1·33
4	14,330	11,850	1·21
5	7,280	5,800	1·25
		average	1·39
without radium	1,280	1,050	1·22

The variations in results are due to changes in hygrometric conditions, or to the presence of water vapour. One point is well marked, namely, that although the γ-rays of radium produce equal quantities of positive or negative electricity, the ionisation of a gas in a closed vessel leads to the production of a large excess of positive electricity.

F. M. G. M.

Effect of Temperature on Ionisation. J. Arnold Crowther (*Proc. Roy. Soc.*, 1909, 82, *A*, 351—357).—The ionisation produced by Röntgen rays has been measured in air at the temperature of liquid air, and in ethyl bromide and methyl iodide at various temperatures up to 184°. In every case the ionisation produced was found to be independent of the temperature if the density of the gas remained constant.

G. S.

Ionisation [Produced] in Various Gases by Secondary γ-Rays. R. D. Kleeman (*Proc. Roy. Soc.*, 1909, 82, *A*, 358—377).—The ionisation produced in various gases and vapours by secondary γ-rays has been measured by the usual method. Zinc, carbon, and lead were used as radiators. The results are given in tabular form, and are compared with those obtained for α-, β-, and primary γ-rays, and for soft and hard *X* rays by previous observers.

The results can be divided into three sets. The first set consists of gases the molecules of which are composed of atoms of hydrogen, carbon, nitrogen, oxygen, sulphur, chlorine; in these the ionisation is much the same for α-, β-, and primary and secondary γ-rays, and does not vary much with the nature of the radiator. The second set consists of gases the molecules of which contain at least one atom of greater mass than the chlorine atom; for these the ionisation is greater for secondary than for primary γ-rays, and the ionisation for different rays varies considerably with the nature of the radiator. The third class consists of hydrogen, which shows several peculiarities.

The ionisation for the various gases, with the exception of hydrogen, is approximately additive, being made up of the sum of the atomic ionisations. The atomic ionisations for the primary and secondary γ rays are plotted as ordinates against the atomic weights as abscissæ, and it is shown that, whereas the upward slope of the curve for the secondary rays increases with increase of atomic weight, the curve for the primary rays shows no increase in slope.

The degree of ionisation depends somewhat on the direction of propagation of the secondary rays with respect to that of the primary.

G. S.

Heat Developed by Polonium. WILLIAM DUANE (*Compt. rend.*, 1909, 148, 1665—1667).—The heat liberated by 0·2 gram of a salt rich in polonium, but free from radium and radiothorium, has been measured by the method previously described (this vol., ii, 534). In order to absorb in the thermo-junction the heat disengaged by the polonium, a current of 0·00143 ampere was required, corresponding with a liberation of 0·0117 cal. per hour. The ionisation produced in air by the α-rays from the same quantity of polonium was found to give a saturation current of $1·3 \times 10^{-7}$ amperes. According to Rutherford the same saturation current is obtained with 0·749 mg. of radium bromide free from emanation and induced activity. This quantity of radium bromide disengages 0·011 cal. per hour (Duane, *loc. cit.*), a value very near that now found for the polonium (0·0117 cal. per hour).

Polonium and radium emit α-particles only, and these have approximately the same range (38·6 mm. and 35 mm. respectively), that is, the same kinetic energy. Since quantities of polonium and radium producing the same ionisation effect develop almost the same amounts of heat, it appears probable that the heat given out by these two substances is derived from the kinetic energy of the α-particles emitted.

R. J. C.

Effect of Temperature on the Rate of Production of Uranium-*X*. R. W. FORSYTH (*Phil. Mag.*, 1909, [vi], 18, 207—209).—Uranium nitrate, freed from uranium-*X* by Crookes's method, was ignited, and the resulting oxide divided into two equal portions. These were enclosed in quartz tubes, one being kept at the temperature of the laboratory, the other heated at 1000°. The rate of formation of uranium-*X* in the two specimens was followed by measurements of the β-ray activity. The results indicate that the rate of production of the β-ray substance at 1000° is not sensibly different from that at the ordinary temperature.

H. M. D.

Distribution of Thorium in the Earth's Surface Materials. JOHN JOLY (*Phil. Mag.*, 1909, [vi], 18, 140—145. Compare this vol., ii, 458).—The values previously recorded for the thorium content of various minerals are reduced by one-third as a result of a re-standardisation of the author's electroscope. New data for the rocks of the St. Gothard Tunnel have been obtained, and for these it appears that the thorium content is roughly proportional to the quantity of uranium present.

H. M. D.

Physical Origin of the Liberation of Electricity in Chemical Reactions. MAURICE DE BROGLIE and L. BROZARD (*Compt. rend.*, 1909, 148, 1596—1598; this vol., ii, 535).—The liberation of electricity in chemical reactions is not due to any chemical causes; it is a physical phenomenon caused by the rupture either of a liquid surface or of the surface of a crystal.

If crystalline salts are heated to such a temperature that they decrepitate without, at the same time, undergoing decomposition, electrically charged powders are obtained, owing to the breaking of the crystal surfaces; if the salts have been fused previously and are heated to the same temperature, there is no electrical charge. On the other hand, when amorphous powders, such as lead carbonate, are decomposed by heat, there is no liberation of electricity, silver oxide being, however, an exception.

When gases are prepared in the wet way, their electrical charge is solely due to the splashing of the bubbles of gas in the liquid. This explains the charged fumes which are formed when such substances as sulphur trioxide or phosphorus pentachloride are thrown into water; if these substances are simply exposed to moist air, the fumes are not charged. Certain liquids, for example, benzene, do not become charged when agitated (splashed), and in these cases the fumes evolved when they are submitted to the vigorous action of nitric acid are not charged.

In chemical reactions which give rise to a charged powder, and, at the same time, a high temperature, the electrical charge may be due to a physical cause, although the experiments of Garrett and Willows (Abstr., 1907, ii, 524) indicate that there is a chemical expulsion of electrons, and the charge acquired by heated salts has been studied by J. J. Thomson (Abstr., 1907, ii, 221). T. S. P.

Measurement of the Intensity of the Field along the Axis of a Coil of Wire by Weighing, and its Application to the Deduction of Absolute Values of the Verdet Constant of Certain Liquids. N. Stoyanoff (*Physikal. Zeitsch.*, 1909, 10, 430—438).—Measurements of the electromagnetic rotation of the plane of polarisation have been made for light of various wave-lengths. From these the Verdet constants for carbon disulphide, benzene, and nitrobenzene have been deduced. H. M. D.

Molecular Condition of Salts Dissolved in a Fused Salt. II. The Electrical Conductivity of Salts in Fused Mercuric Chloride. H. W. Foote and N. A. Martin (*Amer. Chem. J.*, 1909, 41, 451—457. Compare Abstr., 1907, ii, 440).—Beckmann (Abstr., 1907, ii, 739) has recently found that the molecular weights, as determined by the freezing-point method, of the alkali chlorides and of mercurous and cuprous chlorides in fused mercuric chloride agree very closely with these calculated in every case except that of cuprous chloride, in which the values found lie between those necessary for CuCl and Cu_2Cl_2. The authors have now investigated the conductivities at 282° of such solutions, using platinum electrodes in a special apparatus. It is found that the molecular conductivities are high, and that they decrease with the dilution in every case. The salts used were cuprous chloride and the chlorides of cæsium, potassium, sodium, and ammonium. Chlorides of bivalent metals were nearly all insoluble.

The explanation given of the results is that a complex salt is formed, which then dissociates in solution: $2MCl + HgCl_2 \longrightarrow Mg_2HgCl_4 \longrightarrow \overset{+}{M} + MHgCl_4$. Two molecules of alkali chloride give two ions, so that the depression due to the ions would be the same as that due to the original salt. The dissociation expressed by the above equation should be independent of the dilution; the increase in conductivity with the concentration is probably due to the formation of some other complex salt in solution.

Solutions of mercurous chloride do not conduct electricity, in marked contrast to those of cuprous chloride. T. S. P.

Absolute Zero of Potential. Jean Billiter (*Zeitsch. Elektrochem.*, 1909, **15**, 439—440).—In reply to Freundlich and Mäkelt (this vol., ii, 368), the author upholds the accuracy of his views, and thinks that the exceptional behaviour of ammonia which they observed is not a sufficient reason for rejecting the evidence in very different directions which he has accumulated. T. E.

Ionisation of Air by High Tension Electric Cables. Louis Houllevigue (*Compt. rend.*, 1909, **148**, 1668—1670).—It has been suggested that high tension aerial transmission lines give off swarms of ions which bear enormous electric charges into the air and may give rise to storms. The author estimates the ions in a volume of air by drawing it slowly through a cylindrical condenser connected to a charged electroscope The number of ions deposited in the condenser is proportional to the discharge of the electroscope.

Air collected 3 cm. from the spark of a Ruhmkorff coil contained $2{\cdot}8 \times 10^5$ negative ions per c.c., the charge per ion being taken as $3{\cdot}4 \times 10^{-10}$ coulomb. The same air after passing through 5 metres of rubber tube contained only $0{\cdot}44 \times 10^5$ negative ions per c.c. The air in a Marseilles street contained $0{\cdot}16 \times 10^5$ negative, and $0{\cdot}20 \times 10^5$ positive, ions per c.c.

Measurements were taken of the air at 200 metres and 10 metres from an aerial line conveying 3-phase current at 50,000 volts. As these showed no appreciable ionisation, experiments were continued in the receiving chamber, where, owing to the lightning conductors, continuous discharges occur with formation of ozone. Air was also examined in the transforming station at 30 cm. from the cables with a rubber tube, or at 1 metre distance without rubber tube. In all cases the ions were fewer in the neighbourhood of the high tension cables than in the air of the surrounding country, and considerably less than in Marseilles. R. J. C.

Cathodic Volatilisation of Metals in Dilute Gases. V. Volkmar Kohlschütter (*Zeitsch. Elektrochem.*, 1909, **15**, 316—328).—The author's previous results (Abstr., 1908, ii, 457, 799, 800, 925) were obtained with the fluctuating current of an induction coil, and the electrical conditions were therefore ill-defined. The experiments described in this paper are made with the direct current of a Töpler electrical machine, and the cathode fall of potential and the current passing are measured. The cathode used is a wire sealed into a glass tube and placed in the centre of a glass globe so that the discharge is not influenced by the walls of the vessel. The discharge is prevented from taking place from the glass tube carrying the cathode by means of a disc of mica which is fitted at the base of the wire. The results confirm those obtained by Holborn and Austin (*Wiss. Abhand. Phys.-Techn. Reichsanstalt*, 4, 101) in air. In nitrogen, volatilisation begins at a certain value of the cathode fall, which is the same for all metals (570 volts), and then increases in proportion to it. It is also proportional to the equivalent of the metal if the valencies of the metals are taken as follows: silver, 1; gold, 2; platinum, 3; palladium, 2; copper, 2, and nickel, 4. The magnitude of the volatilisation is in the order given. In argon, gold is more volatile than silver, the order being otherwise the same. Silver and platinum begin to volatilise when the cathode fall of potential is 420 volts; the other metals begin at 570 volts as in nitrogen. The valencies found in argon are also different; gold, silver, palladium, and copper are univalent, and platinum and nickel bivalent.

In hydrogen the volatilisation is always small, and the quantities volatilised instead of increasing regularly with the cathode fall appear very quickly to reach a maximum or become constant.

Calling P the quantity volatilised (mg. $\times 10^{-1}$) by a current of 7×10^{-4} ampere in thirty minutes, V the cathode fall in volts, A the atomic weight, and n the valency, $P = k.A(V-S)/n$, where S is the cathode fall at which volatilisation begins. The mean values of $n.k/A$ are in nitrogen 0·000396, and in argon, 0·000371.

With the same current and the same cathode fall the volatilisation is always greatest in argon, and least in hydrogen.

The quantity volatilised is proportional to the current. T. E.

Thermo-elements. O. Knopp (*Physikal. Zeitsch.*, 1909, 10, 439—445).—The dependence of the thermo-electric force on the resistance of the junction, on the nature of the juxtaposed metals or alloys and on the percentage composition of the alloys, on the thickness of the wires, and the influence of temperature and gas pressure, has been experimentally examined. H. M. D.

Oxide Theory of the Oxygen Electrode. IV and V. Richard Lorenz and Percy E. Spiellmann (*Zeitsch. Elektrochem.*, 1909, 15, 293—297, 349—355. Compare this vol., ii, 15, 371, and 463).—In the first part of the paper the *E.M.F.*'s of a platinum oxide electrode and a hydrogen electrode are measured by the compensation method, that is, with no current flowing. The platinum oxide electrode was made by surrounding a platinum wire with a paste of the oxide in *N*-sulphuric acid, or sometimes acetic acid. Some salts of platinum are also examined in saturated solution. The mean values found are: $PtO_2,4H_2O$, (0·829) volt; $PtO_2,3H_2O$, 0·982 (0·736) volt; $PtO_2,2H_2O$, 0·965 (0·722) volt; $PtO,2H_2O$, 0·949 (0·647) volt; K_2PtCl_6, 0·740; $PtCl_4$, 0·936; K_2PtCl_6, 0·720; $PtCl_2$, 0·875, and $BaPt(CN)_6$, 0·604. The numbers in brackets refer to acetic acid solutions. Among the oxides, the greater the content of oxygen and water the greater is the *E.M.F.*, but the values lie so near each other that the authors suspected some error. It is known, for example, that platinous oxide decomposes into platinum dioxide and platinum. Another method was therefore tried in which the cell was allowed to discharge through a high resistance. The *E.M.F.* time curve then shows a number of arrests, each of which corresponds with some definite compound. From the study of a very large number of such curves, the following *E.M.F.*'s (in *N*-sulphuric acid) are taken as corresponding with the known oxides.

$PtO_2,4H_2O$, 0·93 volt; $PtO_2,3H_2O$, 0·86 volt; $PtO_2,2H_2O$, 0·74 volt; $PtO,2H_2O$, 0·45 volt. In addition to these four arrests, six others were observed; these are provisionally ascribed to the following compounds: PtO_2,H_2O, 0·63; PtO_2, 0·53; PtO,H_2O, 0·34; PtO, 0·25; $PtSO_4$, 0·15, and Pt, 0·05.

These *E.M.F.*'s agree with those found by Lorenz and Lauber in the discharge curves of polarised platinum electrodes. The three highest points observed by these authors are not, however, as yet identified. T. E.

Graphite Cathode Dish. J. W. TURRENTINE (*J. Physical Chem.*, 1909, **13**, 438—448).—A graphite cathode dish which can take the place of the Classen platinum dish as cathode in many electro-chemical operations is described. The dish was turned on a lathe, and, after treatment with paraffin, it no longer rubbed off on the finger or absorbed solutions placed in it. It could not be dried after an experiment by treatment with alcohol like a platinum dish, but satisfactory results were obtained by drying directly over the smokeless flame of a Bunsen burner. The electrolytic estimation of solutions of copper sulphate, using the graphite cathode and a copper anode, gave satisfactory results when compared directly with a coulometer containing a copper cathode. A graphite anode has been designed for use with the dish, and the efficiency of the apparatus is being further tested. G. S.

Piezochemical Studies. ERNST COHEN and L. R. SINNIGE (*Zeitsch. physikal. Chem.*, 1909, **67**, 1—47).—A detailed account of work already published (compare this vol., ii, 291). G. S.

Magnetic Transformation of Lead. LUTSHINSKY (*Compt. rend.*, 1909, **148**, 1759—1760).—The coefficient of magnetisation of lead crystals obtained from the fused substance is about ten times greater than that for lead which has been mechanically treated by hammering or drawing into wire. The coefficient varies with the treatment.

Similar results have been obtained with a lead-tin alloy containing 30% of tin, but not with pure zinc, tin, ammonium nitrate, or potassium chloride. The compound $Zn_{10}Fe$ is not magnetic until fused; the magnetic properties are then due to the partial separation of iron. T. S. P.

Magnetic Dichroism of the Rare Earths. GEORGES MESLIN (*Compt. rend.*, 1909, **148**, 1598—1599).—In the group of the rare earths the magnetic properties of neighbouring elements differ considerably, although the solubilities of their salts are almost identical and their atomic weights only slightly different (compare Urbain, Abstr., 1909, ii, 116).

The author has studied the magnetic dichroism and the dichroism of the oxalates of lanthanum, samarium, gadolinium, and dysprosium in five different liquids. The magnetic dichroism of lanthanum and dysprosium is more marked than that of samarium and gadolinium, gadolinium being inactive in four out of the five liquids. Gadolinium and dysprosium do not show ordinary dichroism. T. S. P.

Metronome Interrupters for Electromagnetic Stirrers in Freezing-point Apparatus. Ernst Beckmann (*Zeitsch. Elektrochem.*, 1909, **15**, 355—357).—When a metronome is used to make and break the electrical circuit of an electromagnet, sparks are apt to spoil the contact. A detailed description with figures is given of two arrangements which have been found satisfactory; the contact piece is simply made movable, so that a clean surface can be brought into action. T. E.

Ebullioscopic and Cryoscopic Measurement of Molecular Weights in Iodine. Ernst Beckmann (*Zeitsch. anorg. Chem.*, 1909, **63**, 63—64).—Iodine, like chlorine and bromine (Abstr., 1903, ii, 235; 1906, ii, 845; this vol., ii, 137), is a good solvent. Ebullioscopic measurements give the molecular weights corresponding with Al_2I_6 and Fe_2I_6; sulphur gives S_8, and selenium, S_2. The ebullioscopic constant, determined by means of Sn, Bi, and $SbSnI_4$, is 110°. The cryoscopic constant, from experiments with Sn, SnI_4, HgI_2, Sb, and CH_3I, is 210 (253·5: Timmermanns, Abstr., 1906, ii, 429). Sulphur and selenium give the same results as on boiling. Since at 860° selenium still has a molecular weight in excess of Se_2, the temperature of the iodine does not appear sufficiently high to cause dissociation of the Se_{10} and Se_8 molecules. Violet solutions of iodine in carbon disulphide or carbon tetrachloride become brown on shaking with selenium, and combination thus appears to occur. The iodine-selenium freezing-point curve, however, does not indicate the formation of a compound (Pellini and Pedrina, Abstr., 1908, ii, 833). C. H. D.

Pressure Regulator for Vacuum Distillation. Hermann J. Reiff (*Zeitsch. angew. Chem.*, 1909, **22**, 1360—1361).—The apparatus described is an improved form of Bertrand's pressure regulator (Abstr., 1903, ii, 643). It consists of a Y-shaped tube *A*, *B*, *C*, into the lower limb of which a closed tube, *H*, is ground so as to be capable of rotation vertically. The other limbs, *A* and *B*, each carry a bulb and a short tube, indicated respectively by *D E* and *F G*.

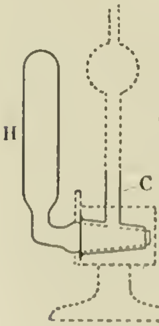


Fig. 1.

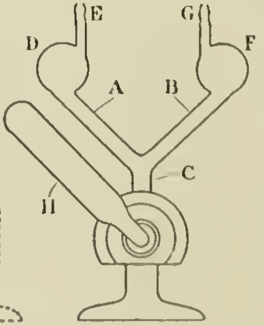


Fig. 2.

Tube *H* and part of *C* are filled with mercury, *D* and *F* are filled with glass beads to arrest mercury spray, and *E* is connected to the pump and *G* to the distillation apparatus. When the pressure is reduced to a certain point, the mercury will sink in *H* and rise in *C* sufficiently to close the passage through *A B*. The pressure at which this occurs is regulated by rotation of the mercury tube *H*, the vertical position indicated in Fig. 1 being that of maximum pressure, Fig. 2 a position of decreased pressure. J. V. E.

Measurement of the Saturation Pressure of Water Vapour below 0°. Karl Scheel and Wilhelm Heuse (*Ann. Physik*, 1909, [iv], **29**, 723—737).—Measurements have been made of the vapour pressure of supercooled water between 0° and $-15{\cdot}3°$, and of ice between 0° and $-68°$. The pressures were recorded by means of a Rayleigh manometer. As the sum of several determinations, the vapour pressure at 0° is $4{\cdot}5788 \pm 0{\cdot}0006$ mm. The variation of pressure with temperature cannot be satisfactorily represented by the formula of Hertz or that of Thiesen. On the other hand, the experimental data show a maximum difference in the vapour pressures of water and ice at $-11{\cdot}7°$, and this is the temperature indicated by Thiesen's formula.
H. M. D.

Simple Method for Determining Vapour Densities. IX and X. Philip Blackman (*J. Physical Chem.*, 1909, **13**, 426—432. Compare this vol., ii, 298).—A modified method for determining the vapour density of liquids is described. In a long capillary tube is placed a thread of mercury, and at some distance from the latter a thread of the liquid in question, the tube is sealed, heated to a temperature at which the liquid is completely vaporised, and the density calculated as in the method already described. Further practical details in connexion with the previous methods are given.
G. S.

New Method for Determining Vapour Densities. VII and VIII. Philip Blackman (*J. Physical Chem.*, 1909, **13**, 433—435. Compare this vol., ii, 298).—A method for determining vapour densities is described, in which the increase of pressure produced when a known weight of liquid is vaporised at constant volume is determined.
G. S.

Simple Method for Determining Vapour Densities and for Analysing Binary Mixtures. Philip Blackman (*Chem. News*, 1909, **100**, 13—14).—A method for determining vapour densities, very similar to that already given by the author, is described in detail. The apparatus may also be used for analysing binary mixtures when the respective vapour densities of the components are known.
G. S.

Calculation of Critical Densities. Reginald O. Herzog (*Zeitsch. Elektrochem.*, 1909, **15**, 345—348).—If Avenarius' equation: $v = a - b\log(T_k - T)$, where v is the specific volume of a substance at the absolute temperature T, T_k its critical temperature, and a and b are constants which depend on the nature of the substance, is divided all through by the critical volume, the quantities a/v_k and b/v_k are found to be constants for all non-associated substances. The critical density may, therefore, be calculated for such compounds from the formula $d_k = d[0{\cdot}906 - 0{\cdot}233\log(T_k - T)]$. The calculated values (for 40 substances) differ occasionally as much as 10% from those observed, but the agreement is in most cases much better.

T. E.

New Form of Characteristic Equation of Gases. Anatole Leduc (*Compt. rend.*, 1909, 148, 1670—1673. Compare this vol., ii, 298, 381, 382).—Since Van der Waals' and other equations do not satisfactorily represent deviations from Boyle's law between 0 and 3 atmospheres pressure, the author endeavours to formulate an equation of the Clausius type which shall do so.

The equation given is $(P + F/v^2)(v - h) = k\theta$, where h and k are constants, and F is a somewhat complicated function of the temperature θ. To h is assigned the value $3/8\sqrt{2} = 0{\cdot}265$ calculated by O. E. Meyer. Employing the known values of the specific volume and critical density of carbon dioxide, nitrous oxide, and sulphur dioxide, k is found to be about 3·6. By the use of these constants, the critical densities and internal pressures of sixteen gases are approximately calculated. There appears to be a systematic error, however, which may necessitate a further term in the characteristic equation.

R. J. C.

Heat of Formation of Titanium Dioxide and Heat of Combination of Acidic Oxides with Sodium Oxide. William G. Mixter (*Amer. J. Sci.*, 1909, [iv], 27, 393—397).—The heat developed in the oxidation of metallic titanium by sodium peroxide corresponds with the equation $Ti + O_2 = TiO_2$ (amorphous) + 215,600 cal. From measurements of the heat developed in the action of sodium peroxide on titanium dioxide, lead peroxide, zirconium dioxide, and ceric oxide, the following data are obtained: $Na_2O + TiO_2 + O = Na_2TiO_4 + 69{,}700$ cal.; $Na_2O + PbO_2 = Na_2PbO_3 + 38{,}700$ cal. With zirconium dioxide the fusions obtained were not satisfactory, but the results indicate that the union of the acid and basic oxide is attended by only a small development of heat. In the case of cerium the thermal data indicate that sodium oxide does not combine with the acid oxide.

H. M. D.

Comparisons between Nitriles and Carbylamines. Paul Lemoult (*Compt. rend.*, 1909, 148, 1602—1604. Compare Abstr., 1907, ii, 10).—The author compares the experimental values obtained by Guillemard (*Thesis*, Paris, 1908) for the heats of combustion of methyl-, ethyl-, propyl-, *iso*butyl-, *iso*amyl-, benzyl-, and allyl-carbylamines with the theoretical values calculated from his own formula (Abstr., 1904, ii, 382), adopting 17 Cal. as the thermal equivalent of the carbylamine grouping. The results are found to be in close agreement. The heats of combustion of the following nitriles have also been determined: acetonitrile, 304 Cal.; propionitrile, 458·5 Cal.; *n*-butyronitrile, 616·3 Cal.; *iso*valeronitrile, 775·7 Cal.; α-naphthonitrile, 1333·2 Cal.; β-naphthonitrile, 1327·3 Cal. These values also accord closely with the calculated numbers. W. O. W.

Absorption of Carbon Dioxide by Charcoal. ALEXANDER E. M. GEDDES (*Ann. Physik*, 1909, [iv], 29, 797—808).—The amount of carbon dioxide absorbed by cocoanut charcoal at different pressures has been determined for 14°, 31°, and 35°. The observations, which extend up to approximately one atmosphere, are in satisfactory agreement with the equation $v=ap^n$, in which v is the volume of carbon dioxide absorbed by unit volume of charcoal, p the pressure, and a and n are constants. The values of the constants vary with the temperature.

The absorption process is not reversible, so that when the pressure is reduced to a lower value, the amount of carbon dioxide retained by the charcoal is greater than that which would be absorbed at this lower pressure. The process of gas evolution does not appear to be regulated by any simple law. H. M. D.

Hydraulic Viscosity of Liquids. EMIL BOSE and DIETRICH RAUERT (*Physikal. Zeitsch.*, 1909, 10, 406—409).—With the object of obtaining information in regard to the constants which determine the "hydraulic" flow of liquids through a capillary tube, the times required for the efflux of a given volume of liquid have been determined for pressures ranging from about 0·005 to about 2 kilo. per sq. cm. For the lower pressures the motion of the liquid is that required by Poiseuille's equation, whereas for the higher pressures the flow is hydraulic in character. The substances examined were water, ethyl alcohol, ethyl acetate, benzene, toluene, acetone, chloroform, bromoform, and mercury. The tabulated data indicate that the relative rates of flow of two liquids frequently change, so that the one which is more viscous at the lower pressures is apparently less viscous at higher pressures. H. M. D.

Determination of a Constant in Capillarity. R. D. KLEEMAN (*Phil. Mag.*, 1909, [vi], 18, 39—44).—A relationship has been deduced between the surface energy and the internal latent heat of vaporisation at a given temperature and the molecular weight, critical temperature, and critical density. It is shown that the experimental data for ethyl ether, methyl formate, carbon tetrachloride, benzene, and chlorobenzene are in satisfactory agreement with the relationship. H. M. D.

Diffusion Velocity and Size of Particles in Disperse Systems. THEODOR SVEDBERG (*Zeitsch. physikal. Chem.*, 1909, 67, 105—111).—Einstein (*Ann. Physik*, 1905, [iv], 17, 549; 1906, 19, 371) has deduced the formula $D=RT/6\pi\eta PN$ (where D = diffusion-coefficient, η = viscosity of medium, N = number of molecules in a mol. of substance, P = radius of the particles, and the other symbols have the usual significance) for the relationship between the rate of diffusion and the size of the particles in a colloidal solution, and in the present paper the formula is proved to be valid.

In the first place, two solutions of colloidal gold, containing particles of magnitude 1—3 $\mu\mu$ and 20—30 $\mu\mu$ respectively, have been prepared by methods described by Zsigmondy, and, from observations on the relative rates of diffusion through parchment paper, it is shown that $D_1/D_2 = P_2/P_1$, as the theory requires.

Further, a solution of colloidal gold containing still smaller particles has been prepared, and its coefficient of diffusion into water determined by Scheffer's method; $D^{117} = 0·27$. Substituting this value in Einstein's formula, and putting $N = 7 \times 10^{23}$, the value $P =$ 0·94 $\mu\mu$ is obtained for the diameter of the particles, in almost exact agreement with the value determined ultramicroscopically by Zsigmondy for solutions of this type. G. S.

Dependence of the Gas Diffusion Coefficient on the Mixture Ratio. ANTON LONIUS (*Ann. Physik*, 1909, [iv], 29, 664—678).—An examination of the data obtained in recent experimental work on the diffusion of gases into one another shows that in all cases the coefficient of diffusion depends on the relative proportions of the mixed gases, that is to say, on the density gradient. This result is opposed to the requirements of the diffusion theory of Stefan-Maxwell. H. M. D.

Classification and Nomenclature of Disperse Systems. P. P. VON WEIMARN (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 44—46).—A further scheme for the classification of the different types of disperse systems is described. H. M. D.

Rate of Solution of Gases in Water. W. A. ROTH (*Zeitsch. Elektrochem.*, 1909, 15, 328—331. Compare J. Meyer, this vol., ii, 471; Luther and MacDougall, Abstr., 1908, ii, 361).—The rate of absorption of nitrous oxide and of carbon dioxide in water, and also the rate at which they are removed from solution by a current of hydrogen, are measured by means of the heat evolved or absorbed, or by measuring the freezing point of the solutions. The rate is proportional to the difference between the concentration of the gas in the saturated solution and that in the solution at the moment of measurement. T. E.

Apparatus for the Determination of Solubilities at the Boiling Point of the Solvent. JOHANNES SCHROEDER (*Zeitsch. anal. Chem.*, 1909, 48, 349—350).—The apparatus consists of a graduated boiling tube, which is connected by ground-glass joints with a vertical reflux condenser. A narrow tube, which is sealed through the wall of the boiling tube and reaches almost to the base of the latter, permits of the removal of the saturated solution for analysis. The solute is added in successive portions until the boiling point registered by a thermometer, divided into tenths of a degree, has attained a maximum value. H. M. D.

Simple Apparatus for Extraction in the Cold and for the Determination of Solubility at Room Temperature. JOHANNES SCHROEDER (*Zeitsch. anal. Chem.*, 1909, 48, 351—352).—The apparatus is designed to prevent the evaporation of volatile liquids during the process of filtration from admixed solid substances. It consists of a graduated, cylindrical, separating tap funnel, the lower end of which fits into the cover of a funnel, the lower end of which fits in turn into the mouth of a graduated cylinder. The cover and the funnel proper are connected by a ground-glass joint. To eliminate pressure differences, the upper parts of the separating funnel and the lower cylinder are connected by a side-tube. By means of this arrangement a saturated solution contained in the upper cylinder can be filtered without appreciable loss of the volatile solvent by evaporation.

H. M. D.

Solubility of Salts in Concentrated Acids. ARTHUR E. HILL and JOHN P. SIMMONS (*J. Amer. Chem. Soc.*, 1909, 31, 821—839).—Investigations dealing with the influence of the common ion in reducing the solubility of compounds and with the action of strong acids in increasing the solubility of salts of weak acids have hitherto been chiefly carried out with dilute solutions. The work now described has been performed with the object of obtaining data on solubility relations in concentrated solutions, and of testing the applicability to such solutions of the laws relating to dilute solutions.

Experiments have been made to determine the increase of solubility of several salts on addition of nitric acid of varying concentration (usually up to $5N$ and, in some cases, up to $10N$) to their aqueous solutions. The salts studied were silver acetate, chloroacetate, oxalate, iodate, and sulphate, and thallous chloride. The results are tabulated and plotted as curves. A mathematical solution of the known laws bearing on solubility relations has been developed.

On comparing the experimental and calculated results, it is found that the laws for dilute solutions are valid for highly concentrated solutions of a salt of a weak acid in a strong acid, whilst, under the same conditions, the solubility of a salt of a strong acid is greatly depressed by some factor probably connected with the neutral salt effect, but not yet capable of quantitative expression. E. G.

Diminution of the Cohesion Pressures and of the Solubilities of Salts by Non-Electrolytes. ISIDOR TRAUBE (*Ber.*, 1909, 42, 2185—2188. Compare this vol., ii, 216).—The following generalisation is given: Substances with appreciable cohesion pressures in water (for example, salts) diminish the solubilities of substances with small cohesion pressures (for example, organic compounds). The greater the difference in the cohesion pressures the greater is the diminution of the solubility.

The effects of the addition of non-electrolytes on the solubilities of salts in water have been investigated. The salts used were lithium carbonate, silver sulphate, and potassium bromate, and various organic compounds were used as the non-electrolytes. The values $100/n \log l_0/l$

have been calculated, where l_0 is the solubility of the salt in water, l is the solubility in the presence of the non-electrolyte, and n is the molecular concentration of the latter.

The author claims that the results prove that the cohesion pressure of the non-electrolyte determines the solubility of the salt.

J. J. S.

Properties of Colloidal Solutions. I. The Osmotic Pressure of Congo-Red and of some other Dyes. William M. Bayliss (*Proc. Roy. Soc.*, 1909, 81, *B*, 269—286).—The nature of solutions of Congo-red has been investigated. Although Congo-red is unable to diffuse through parchment paper and exhibits other colloidal properties, it exerts an osmotic pressure equal to that which would be expected if it were present in true solution in the form of simple molecules. The theoretical osmotic pressure is only attainable in the complete absence of extraneous electrolytes. Small quantities of acid, alkali, or neutral salts cause a marked diminution in the observed osmotic pressure, and even the carbonic acid present in ordinary distilled water is sufficient to produce a considerable effect. The electrolytes are supposed to act by causing the aggregation of molecules to particles. Stable colloids, such as serum-albumin, exert a protective action on Congo-red and also on arsenious sulphide, and this is due to the formation of minute aggregates, which result in a fall of the osmotic pressure, but the aggregates are not of sufficient size to precipitate.

By dialysis, a blue colloidal solution of the free acid of Congo-red can be obtained. This is easily resolved under the ultra-microscope, but it shows a definite, although small, osmotic pressure, which for a 1% solution amounts to about 14 mm. of mercury. On the basis of the kinetic theory this corresponds with the formation of aggregates which contain, on the average, twenty molecules. The entire observations are capable of explanation on the assumption that colloidal particles possess the kinetic energy of molecules, but they are opposed to the view according to which foreign electrolytes are necessary for the development of the phenomena.

H. M. D.

Fractional Precipitation from Solution. Philip Blackman (*J. Physical Chem.*, 1909, 13, 436—437).—An algebraic proof of the well-known result that if a substance is dissolved in a liquid and another used to precipitate it, more can be precipitated by using the latter liquid in portions than in one operation.

G. S.

Spontaneous Crystallisation of Drops of Solutions as Spherulites. Jacques Chevalier (*Min. Mag.*, 1909, 15, 224—231).—Drops of solutions of lithium sulphate, ammonium sulphate, lithium phosphate, iron sodium sulphate, manganese potassium sulphate, potash alum, and lithium sodium sulphate, were examined under the microscope. Spherulites and sphero-crystals are in most cases the results of spontaneous crystallisation. When other crystals grow first, it is probably because they have been introduced, the drop in that case appearing to be metastable. The spherulites mark the passage of the solution to the labile state (Trans., 1906, 89, 413). Spherulites would appear to be generally a modification of the substance with a lower degree of hydration than the ordinary crystals, and to be more stable and less soluble. L. J. S.

Crystallisation through Membranes. James H. Walton, jun. (*J. Physical Chem.*, 1909, 13, 490—500).—The experiments were made by putting a supersaturated solution, or supercooled liquid, in a test-tube, closing the tube by a membrane, and placing it in a beaker containing more of the supersaturated solution in such a way that the membrane and the solution in the beaker were in contact. Crystallisation was then started, preferably in the beaker, and it was observed whether it extended to the contents of the tube. Parchment, collodion, goldbeaters' skin, and rubber, 0·005 inch thick, were used as membranes.

With all the solutions used, crystallisation was propagated sooner or later through the first three membranes, but not in general through the rubber. In the case of certain supercooled liquids, however, such as acetophenone and salol, crystallisation was propagated through the rubber membrane, but not in the case of supercooled water or of phenol containing a little water. G. S.

Kinetics of the Reaction between Alkyl Sulphates and Inorganic Salts. Paul Walden and Mieczyslaw Centnerszwer (*Zeitsch. Elektrochem.*, 1909, 15, 310—316).—The velocities of the reactions between methyl sulphate and sodium, cadmium and stannic iodides, potassium bromide and sodium, potassium, ammonium, and cobalt thiocyanates are measured in methyl alcohol and, in a few cases, in acetone solutions. Only one methyl group reacts, and in all cases the reaction is incomplete, an equilibrium being attained. The equation of the bimolecular reaction applies very well when equivalent quantities of the reagents are used, or when the salt is present in excess, an excess of the methyl sulphate, however, causes the constants to diminish as the reaction proceeds. The temperature-coefficients of the reactions lie between 2·56 and 4·14. The velocity in acetone solution is about one hundred times greater than it is in methyl alcohol. The velocity depends on the nature of both the cation and anion of the salt used, and the more completely the reaction takes place the greater is its velocity. T. E.

Sulphonic Acids and Ostwald's Dilution Law. Rudolf Wegscheider and Paul Lux (*Monatsh.*, 1909, 30, 411—445; Wegscheider, Abstr., 1902, i, 617).—The conductivity at 25° of aqueous solutions of β-naphthalenesulphonic acid, p-toluenesulphonic acid, and their sodium and potassium salts has been determined.

The conductivity values of β-naphthalenesulphonic acid may be represented approximately by the formula $\mu = A + Bv^{-\frac{1}{2}} - Cv^{-1}$, and for solutions having a dilution greater than 80 litres, also by the Kohlrausch-Maltby formula, $(\mu_\infty - \mu) : \mu^p = Cv^{-\frac{1}{2}}$; in both cases, however, regular deviations from the observed values are noticeable. The values derived from the formula $(\mu_\infty - \mu)^p \log V = C$ agree remarkably well with the observed values for solutions up to $0·003N$.

The mol. conductivity of the acids at infinite dilution, μ_∞, derived by extrapolation from interpolation formula for the conductivity values, differs according to the formula employed. In the case of the acids examined, van't Hoff's formula is applicable when a higher value for μ_∞ is chosen.

Ostwald's dilution law is in close agreement with the observations for solutions up to $0{\cdot}006N$ when the value μ_∞ derived from the conductivity of the salts is employed; it also applies to solutions up to $0{\cdot}016N$ when a smaller value for μ_∞ is used. W. H. G.

[Formation of Esters.] HEINRICH GOLDSCHMIDT (*Zeitsch. Elektrochem.*, 1909, 15, 305—310. Compare this vol., ii, 129, 305).—Mainly polemical. A reply to R. Wegscheider and to A. Kailan. Details of older experiments and several new ones on the rate of esterification of 1 : 3 : 5-dinitrobenzoic acid in presence of hydrochloric acid are given. T. E.

The Alcoholysis or Esterification of Acid Amides. E. EMMET REID (*Amer. Chem. J.*, 1909, 41, 483—510).—The rates of esterification at 50° of benzamide and *m*- and *p*-nitrobenzamides in aqueous-alcoholic solution have been measured, using hydrochloric acid as a catalytic agent. The course of the reaction was followed by determining the amount of ammonia formed after different intervals of time. The reaction is found to be bimolecular, and this is accounted for mathematically by assuming that the amide forms a salt with the hydrochloric acid, and that the complex cation is the reactive substance; the reaction equation holds for a range of decomposition from 2 to 75%. Using 99·5% alcohol as solvent, it is found that the velocity constant (K_p) for *p*-nitrobenzamide is 1·17 times that (K_m) for the meta-amide; moreover, K_p and K_m are directly proportional to the molecular conductivity of the hydrochloric acid in the alcohol used as solvent. The velocity constant (K_b) for benzamide is less than K_m. It is not proportional to the molecular conductivity of the hydrochloric acid, probably because benzamide is a comparatively strong base, and consequently an increase in the concentration of the acid will not produce a proportionate increase in the concentration of the complex ion, as it does with the very weak bases *m*- and *p*-nitrobenzamides.

The addition of water considerably retards the velocity of reaction, the effect being greater with *m*-nitrobenzamide than with benzamide. For small additions of water to alcohol, or vice-versa, the changes in viscosity seem able to account very largely for the observed changes in reaction velocities; the greater the viscosity the less the velocity of reaction.

The remainder of the paper is not suitable for abstraction. It consists of a mathematical discussion of the mechanism of the reaction, and is based on the assumption that the hydrions of the catalysing acid form complex ions with the solvent (water or alcohol, or both), and these further combine with the amide, forming more complex ions, which are the reactive substances. It is also shown how the relative rates of hydrolysis and alcoholysis in aqueous-alcoholic solution may be calculated. T. S. P.

Dependence of the Reaction Velocity on the Temperature in Homogeneous Gaseous Systems. Hans Goldschmidt (*Physikal. Zeitsch.*, 1909, 10, 421—422. Compare this vol., ii, 390).—Nernst's conception of a "chemical resistance" which opposes the progress of a reaction is not inconsistent with the view of Arrhenius, that only a certain proportion of the gas molecules are in a chemically active state. H. M. D.

Relation between the Rate of a Chemical Reaction and those of its Intermediate Changes. Gerhard Just and W. Berezowsky (*Zeitsch. Elektrochem.*, 1909, 15, 297—305. Compare Abstr., 1908, ii, 825).—The polarisation of electrodes immersed in a solution containing ferro- and ferri-cyanide is studied in great detail. Using gold electrodes, the rate of stirring the solution was found to affect the polarisation; this source of error was eliminated by using constant, very violent agitation. The polarisation was then found to depend on the previous history of the electrode; a freshly polished electrode is almost unpolarisable, whilst one which has been exposed to the air is polarisable. The polarisable or unpolarisable condition can be produced at will by long immersion in a ferrocyanide solution or short exposure to a ferricyanide solution, so that it appears that an oxidised surface is polarisable. Quite similar results are obtained with platinum, except that it is much less polarisable than gold. Chromium, on the other hand, is practically unaffected by any treatment, and is equally strongly polarisable under all circumstances. It follows that platinum accelerates the reaction $FeCy_6''' + F = FeCy_6''''$ very markedly, gold accelerates somewhat less strongly, and chromium not at all. This conclusion is confirmed by allowing a mixture of potassium ferricyanide and iodide and sodium thiosulphate to react in presence of the metals. Iodine appears in five minutes with no metal, in forty-five to fifty-five seconds in presence of platinum, in 2·5 minutes in presence of gold, and in 5 minutes with chromium. T. E.

Temperature-Coefficient of Chemical Reaction Velocities. III. Physical Meaning of the Velocity Constant, and its Replacement by Thermal Data and the Time Unit for Dilute Solutions. Max Trautz (*Zeitsch. physikal. Chem.*, 1909, 67, 93—104. Compare Abstr., 1908, ii, 824; this vol., ii, 557).—By a thermodynamical method, a complicated expression is deduced for the velocity constant in dilute solution in terms of the thermal data for the reacting substances and the time. Similarly, the equilibrium constant for solutions has been determined, and its dependence on the properties of the solvent is discussed. Further, an expression for the temperature-coefficient of the velocity constant has been obtained.

The maximum in the temperature-coefficient of the velocity of ester saponification, described in a former paper, is probably due to a diminution of the molecular heat of the solvent or the reacting substances with increase of temperature. G. S.

Catalysis. X. Formation of Esters from Amides and Alcohols. Salomon F. Acree (*Amer. Chem. J.*, 1909, 41, 457—483; Abstr., 1908, ii, 1022).—The greater part of this paper is occupied by a recapitulation of the author's views on catalysis.

Acree and Johnson (Abstr., 1907, i, 506; ii, 855) have shown that hydrochloric acid causes a catalysis of acetylbromo(chloro)aminobenzene into *p*-bromo(chloro)acetanilide in proportion to the square of the concentration of the hydrochloric acid, and have explained this by assuming that the reactive substance is an intermediate product formed by the combination of the acetylbromo(chloro)aminobenzene with both the hydrions and chloridions. The experimental data were not completely satisfactory, owing to the high concentrations of the solutions used. It is now found, however, that the action of hydrobromic acid on acetylchloroaminobenzene in 10% acetic acid solution at 3° proceeds rapidly, even in dilute solution, and the velocity has been measured. Good constants are obtained according to the velocity equation: $dx/dt = K(C_a - x)(C_{\mathrm{Br}} - x)C_{\mathrm{H}}$, where C_{H}, C_{Br}, and C_a are respectively the concentrations of the hydrions, bromidions, and acetylchloroaminobenzene.

Attention is called to the importance of investigations on the hydrolysis and esterification of amides, especially the latter, since no appreciable amount of water is formed in the reaction, and hence a very great disturbing factor is eliminated.

As regards the effect of salts on catalytic actions, the author does not agree with Euler's view (Abstr., 1900, ii, 269) that the salt causes an alteration in the dissociation of the water. Salt catalysis is considered to be a very complex phenomenon caused by a combination of effects, such as the following: (*a*) The catalysing salts may combine with the reacting substances, and form still more (or less) reactive double salts or double compounds. (*b*) A change in viscosity is known to have an effect on the velocities of reactions in aqueous-alcoholic solutions, and the salt effect may be dependent on the influence of the salt on the viscosity of the solution. (*c*) Combination may take place between the solvent and solute, thus affecting the concentrations of the reacting substances. (*d*) The thermodynamic potential, or driving force behind each reaction, depends not only on the reacting substances, but also on the surrounding field; the addition of salts affects the field and, therefore, the thermodynamic potential. T. S. P.

New Estimate of the Size of an Atom. H. Stafford Hatfield (*Zeitsch. Elektrochem.*, 1909, 15, 389—390).—The difference of potential between a sphere of mercury of radius r and a flat surface of mercury in contact with the same solution is shown to be $E = (0{\cdot}98 \times 10^{-6})/r$ volt.

Both the curved surface and the solution are negative compared with the flat surface, so that as the radius diminishes the difference of potential between the curved surface and the solution diminishes, and finally disappears when E is about 0·5 volt. The corresponding value of r is $1{\cdot}9 \times 10^{-6}$ cm. The author regards this as an upper limit of the size of an atom. T. E.

Space Relation of Forces in the Atom. FRANK A. HEALY (*Chem. News*, 1909, 99, 302).—From the consideration of eight fields of force (or charges), four of one polarity and four of opposite polarity, arranged symmetrically and equidistant around a sphere, it is apparent that both within and without the sphere the sum of the fields of force will be zero. If, now, one charge be doubled, the internal field value will no longer be zero; designate its value m, then, by successively doubling all the positive charges and then all the negative charges; the internal field will have the values m, $2m$, $3m$, $4m$, $3m$, $2m$, m, 0. When the individual charges are trebled, the same series of values are obtained, both for the internal and external field, and this is repeated as often as a unit charge is successively added. This succession of values is considered to be identical with the normal succession of valency in the periodic table of the elements. J. V. E.

Practical Method for the Simultaneous Calculation of Atomic Weights: General Results. GUSTAV D. HINRICHS (*Compt. rend.*, 1909, 148, 1760—1763).—A table is given containing a résumé of the results obtained by the author in his calculations of atomic weights (Abstr., 1907, ii, 945). It contains (1) the ratio (R) of the molecular weights of the compounds used in the determination of atomic weights, and also the increase of this ratio for a variation of 0·1 in each of the atomic weights. (2) The difference between the ratio of the actual weights of compounds taken and the ratio R. This is called the analytical excess ($=e$), and gives an idea of the accuracy of the experiments. (3) The difference (ϵ) between the experimental and absolute values of the atomic weights. The difference ϵ is given by the equation $10\Sigma\epsilon\Delta = e + K$ (Abstr., 1907, ii, 945). This equation can only be solved by trial, and from the values of ϵ obtained it can be told whether the experimental determinations should be repeated more carefully, varying the quantities of material used, or whether it is probable that there is an error in the absolute atomic weights used (Abstr., 1909, ii, 400).
T. S. P.

True Values of the Atomic Weights. Mathematical Value of the Method of Calculation. LOUIS DUBREUIL (*Bull. Soc. chim.*, 1909, [iv], 5, 660—667).—In previous papers (Abstr., 1908, ii, 936, 1035; this vol., ii, 563) the author has developed Hinrichs' theorem (Abstr., 1893, ii, 317; 1907, ii, 945), that experimentally determined atomic weights (Dubreuil's apparent atomic weights) must always be variable for the same substance, and has given equations whereby true atomic weights may be calculated from the data obtained in any series of reactions. In the present paper a criticism is given of the usual plan, depending on the method of least squares, of calculating true values from experimental data, and it is pointed out that the author's method differs fundamentally from this.

Finally, it is shown that in Hinrichs' equation (Abstr., 1893, ii, 317) $R = a(1 - x + y + n)$, where R is the true value, a the apparent value, x and y quantities dependent on the impurities present, and n a function of the conditions of the experiment, x, y, and n do not tend to become zero with the weight of the substance employed in the reaction, as Hinrichs supposed. T. A. H.

True Values of the Atomic Weights. What is the Mathematical Value of the Author's Method? LOUIS DUBREUIL (*Bull. Soc. chim.*, 1909, [iv], 5, 708—715).—A discussion of the author's method of calculating atomic weights (Abstr., 1908, ii, 936), in which it is pointed out that the equation of condition established by Hinrichs (Abstr., 1907, ii, 945) is indeterminate unless some quite arbitrary assumptions are made. Hinrichs' geometrical solution is a special case of the hypothesis adopted by the author, namely, that the sum of the squares of the deviations of the true atomic weights from whole numbers shall be a minimum. In calculating the International Atomic Weights, the assumption made is that the deviation in the case of oxygen is zero. Hitherto the method has been justified by results. E. H.

True Values of the Atomic Weights. The Determinations of Stas. LOUIS DUBREUIL (*Bull. Soc. chim.*, 1909, [iv], 5, 715—722).—A description is given of Stas' determinations of the value of the ratio $LiCl : LiNO_3$ (Stas, *Oeuvres complètes*, 1). Stas' results are recalculated by the author's method (Abstr., 1908, ii, 936, and preceding abstracts), and the following values obtained for the atomic weights: Lithium 6·9853, chlorine 35·4877, oxygen 16·0299, and nitrogen 14·0075. E. H.

Release of Valency Electrons by Collision. JOHANNES STARK (*Jahrb. Radioaktiv. Elektronik.*, 1909, 6, 168—180. Compare Abstr., 1908, ii, 574).—According to the author's valency theory, chemical dissociation and ionisation are both phenomena which are due to the release of valency electrons by collision of particles. These particles may be neutral atoms or molecules, positive or negative ions, or one of them may be an electron. In order that a valency electron may be released, the kinetic energy of the two colliding particles must be greater than the energy of combination of the valency electron with its corresponding atom. In a similar way the kinetic energy of the colliding particles must exceed a certain value in order that the vibrations of a bound electron may give rise to emission of light. The value of the coefficient which characterises the energy transformation depends on the nature of the colliding particles, and it is pointed out that this view offers an explanation of the phenomenon of catalysis. H. M. D.

Supposed Permeability of Glass for Iodine Vapour. BERNHARD TOLLENS (*Ber.*, 1909, 42, 2013. Compare Zengelis, this vol., ii, 134; Stock and Heynemann, this vol., ii, 563).—Iodine was preserved in sealed thin-walled test-tubes for two months. In no case was the slightest loss observed The observations of Zengelis are denied. E. F. A.

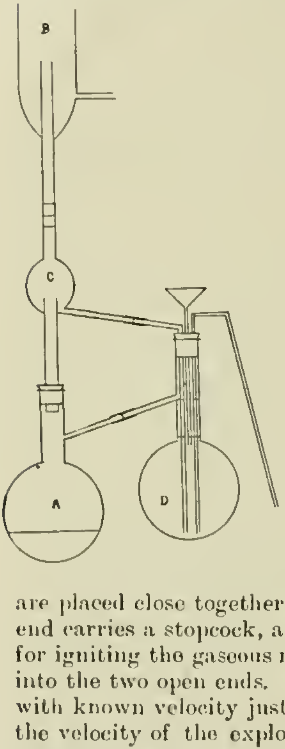
Mercury Pump. MARCEL GUICHARD (*Bull. Soc. chim.*, 1909, [iv], 5, 571—574).—A very simple form of mercury pump is described, which can be constructed from a series of pieces of glass tubing without resort to glass-blowing. The apparatus to be exhausted is connected with a tube *a*, 1 cm. in diameter, which reaches nearly to the bottom of a tube *b*, 2·5 cm. in diameter, which is closed by a rubber stopper and contains mercury. The narrow fall tube *c* terminates above the mercury in *a*, and passes through a hole in the rubber cork. Mercury is allowed to fall from a reservoir into *b* through a similar narrow, thick-walled tube. It is convenient to reduce the pressure down to about 2 cm. of mercury by means of a water pump set up in connexion with the mercury pump. H. M. D.

Constant Level Reservoir. W. P. FITZGERALD (*J. Amer. Chem. Soc.*, 1909, 31, 839—840).—An apparatus is described which is capable of supplying liquid to a funnel as rapidly as filtration takes place. It consists of a cylindrical glass vessel having a neck at the top and provided with a narrow tube at the lower end and a side aperture towards the upper end for the admission of liquids to be filtered. The neck is fitted with a perforated rubber stopper carrying a glass rod, which passes to the bottom of the cylinder and acts as a stopper to the narrow tube. When in use, the apparatus is so supported that the lower end of the narrow tube extends to about 3/16 inch below the edge of the filter paper. The glass rod is pushed down until it closes the narrow tube, and the liquid to be filtered is poured in through the side aperture. The glass rod is then gently raised until sufficient liquid has entered the funnel to close the lower opening of the narrow tube. The side aperture is now closed with a rubber stopper, and the glass rod is raised an inch or two. As the level of the liquid falls in the funnel, the lower opening of the narrow tube is exposed, with the result that air enters the cylinder and a further quantity of liquid flows into the funnel. After a filtration has been made, the precipitate may be washed by filling the apparatus with water.

The apparatus can be used to maintain a constant level in an evaporating dish or in a water-bath, and can also serve as a separatory funnel. E. G.

Apparatus for Intermittent or Continuous Extraction. HENRI VIGREUX (*Bull. Soc. chim.*, 1909, [iv], 5, 699—702).—The apparatus consists of four parts: (*A*) a glass cylinder open at both ends and having near the lower end four symmetrically placed circular holes blown in it; the upper end of this cylinder is flattened somewhat on one side, in order to reduce the size of the opening; (*B*) a piece of glass tubing about twice the length of *A*, and provided at the centre with a bored cork sliding on it; the upper end of this tube is slightly indented at one point to carry the siphon; (*C*) a ⋃-siphon of narrow glass tubing having one arm slightly longer than *B* and the other end about half the length of *B*; (*D*) a pear-shaped glass holder, the upper end of which is corked and carries a condenser, and the lower end is drawn out so that it can be fitted by means of a cork to a flask containing solvent. In using the apparatus, *C* is placed in *B* and the latter in *A*, the junction being wrapped round with cloth and then fine wire gauze, to act as a filter. The apparatus is then placed in *D*, and the powder to be extracted is filled in round it. Thus mounted the apparatus can be used intermittently, but if the siphon *C* is omitted it extracts continuously. The apparatus is figured in the original. T. A. H.

An Apparatus for the Extraction of Liquids with Ether. Augustus H. Fiske (*Amer. Chem. J.*, 1909, **41**, 510—515).—The construction and working of the apparatus is obvious from the diagram. The liquid to be extracted is placed in *D* and the ether in *A*. To obviate the necessity of taking the apparatus to pieces when the liquid in *D* is to be renewed, a siphon is provided to draw off the spent liquid, and a funnel for refilling.



The apparatus was tested on a solution of succinic acid and found to be just as efficient, per c.c. of solution extracted, as the van Rijn apparatus (Abstr., 1896, ii, 17), while it will extract four times as much solution in the same length of time. T. S. P.

A Lecture Experiment to Demonstrate the Velocity of the Explosive Wave in Explosive Mixtures of Gases. Friedrich Emich (*Ber.*, 1909, **42**, 2462—2464).—The apparatus consists of an iron tube, 10 mm. diameter and 10 m. long, in the form of a coil, the two ends of which are bent at right-angles to the main coil and are placed close together and along the same radius of the disc. Each end carries a stopcock, and one is provided with a sparking apparatus for igniting the gaseous mixture. A small amount of soot is introduced into the two open ends. A disc of stout, white paper is made to rotate with known velocity just above the ends of the tube. To determine the velocity of the explosive wave, the disc is rotated, the stopcocks are opened, and the mixture sparked. The measurement of the angle between the two marks made by the soot and a knowledge of the rate of rotation of the disc give the data required for the calculation of the velocity of the explosive wave. J. J. S.

Filtering Apparatus for Microscopic Colouring Matters and Sterilised Solutions. M. Dominikiewicz (*Chem. Zeit.*, 1909, **33**, 670—671).—The smaller of the two apparatus consists of a conical glass vessel which at the lower end is widened to a broad basis, whilst the neck is covered with a small glass bell filled with cotton wool. After the solution of the dye has been sterilised and deposited most of the suspended matters, it is drawn off, when wanted, through the lateral tube by opening the stopcock, when it passes through a little filtering tube plugged with cotton wool.

The larger apparatus consists of a separating funnel fitted laterally with a similar filtering arrangement. The sterilised solution is contained in an ordinary reagent bottle closed with a doubly perforated rubber cork; through one of the openings passes the stem of the funnel and through the other a glass tube, the end of which is enlarged and plugged with cotton wool. The top of the funnel is also furnished with a small bell containing cotton wool. When the colouring matter is required for use, the lower stopcock is temporarily opened, and the solution is drawn up into the funnel by applying suction. It is then run off by opening the stopcock on the lateral tube, when it passes through the filtering arrangement. L. DE K.

Inorganic Chemistry.

Temperature of the Oxyhydrogen Flame. EDMOND BAUER (*Compt. rend.*, 1909, 148, 1756—1757).—Using the same methods as were described previously (Abstr., 1909, ii, 106, 453), the author has determined the temperature of the oxyhydrogen flame. A flame containing a slight excess of hydrogen emits and absorbs the residual rays of fluorspar to a considerable extent, the ratio of emission to absorption being 17·20; applying Planck's formula to the numbers so obtained, the temperature of the flame is found to be 2240°.

Application of the method based on the reversal of the sodium *D*-line gives temperatures varying from 2200° to 2300°, according to the proportion of oxygen. T. S. P.

Formation of Ozone by means of Ultra-violet Light. FRANZ FISCHER (*Ber.*, 1909, 42, 2228—2230; *Physikal. Zeitsch.*, 1909, 10, 453—454. Compare Abstr., 1905, ii, 580; 1906, ii, 224).—The formation of ozone by means of ultra-violet light is confirmed (compare Bordier and Nogier, *Compt. rend.*, 1908, 47, 354). J. J. S.

Affinities of the Nitrogen Atom. JOHN C. THOMLINSON (*Chem. News*, 1909, 99, 290).—The author considers that thermo-chemical data indicate that nitrous oxide, nitric oxide, and nitrogen dioxide contain pentavalent oxygen. H. M. D.

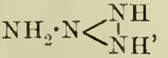
Electrolytic Oxidation of Ammonia. ANDRÉ BROCHET and GEORGES BOITEAU (*Bull. Soc. chim.*, 1909, [iv], 5, 667—675. Compare Millot, Abstr., 1885, 979; 1888, 242).—When ammonia solution is electrolysed, using electrodes of Acheson graphite, a mixture of ammonium carbonate and nitrate is produced. The quantity of nitrate formed increases if ammonium carbonate or nitrate is first added to the solution. A similar reaction takes place if platinum or iron electrodes are used to electrolyse solutions of ammonium carbonate or nitrate in ammonia. Under all the conditions tried, the yield of nitrate is low; it increases with the current density, but the rate of formation diminishes when the concentration of nitrate in the solution becomes considerable. This last phenomenon is probably due to the instability of the nitrite, which, as Traube and Biltz's experiments (Abstr., 1904, ii, 727) indicate, is first formed, although in the present experiments only traces of nitrite were found in the solutions.

Contrary to the experience of Kappeler (*Inaug. Diss. Bâle*), it is found that the gas evolved at the anode when ammonium carbonate or nitrate is electrolysed is a mixture of nitrogen and hydrogen and contains no oxygen.

In using iron electrodes, some ferric hydroxide is formed, and the cathode becomes coated with finely divided iron. The iron appears to be torn from the cathode, perhaps in the form of hydride, and is oxidised in contact with the anode. This action is inhibited by the addition of chromic acid, and the electrolysis then proceeds as with platinum electrodes. T. A. H.

Oxidation of Hydrazine. IV. Arthur W. Browne and F. F. Shetterly (*J. Amer. Chem. Soc.*, 1909, 31, 783—799).—A continuation of the work described in earlier papers (Abstr., 1907, ii, 863; 1908, ii, 373; this vol., ii, 233). The results are given of experiments on the oxidation of hydrazine by cupric sulphate and oxide, Fehling's solution, potassium chromate, mercuric oxide and chloride, arsenic and antimony pentoxides, ozone, chromic sulphate, selenious, selenic, and telluric acids, molybdenum trioxide, ferric oxide, and nickel and cobalt sesquioxides.

Cupric sulphate and cupric oxide in presence of alkali yield small quantities of ammonia under certain conditions, but in no case is azoimide produced. Fehling's solution gives a large amount of ammonia at temperatures between 15° and 95°, but only traces at 100°; azoimide is not formed. Fehling's solution can therefore be used for the estimation of hydrazine if it is employed in excess and maintained at the b. p. during the whole of the reaction. Potassium chromate, in presence of sulphuric acid, yields ammonia in an amount depending on the concentration of the acid and the temperature, and, in some cases, a small quantity of azoimide is produced. When a solution of hydrazine sulphate is heated with mercuric oxide in acid or alkaline solution, neither ammonia nor azoimide is formed, but if the yellow oxide is added gradually to a slightly alkaline solution of the sulphate at 0°, appreciable quantities of both ammonia and azoimide are produced. Mercuric chloride effects the oxidation without formation of either ammonia or azoimide. Arsenic oxide yields traces of both compounds. Ozone, under certain conditions, gives a small quantity of azoimide, but no ammonia. Chromic sulphate yields azoimide. Selenious acid does not give any azoimide, selenic acid yields an appreciable quantity, and telluric acid furnishes large quantities of both azoimide and ammonia. Molybdenum trioxide in acid solution yields appreciable quantities of both azoimide and ammonia. Ferric oxide gives large quantities of ammonia, but no azoimide, whilst nickel and cobalt sesquioxides yield ammonia together with traces of azoimide.

From a consideration of the action of all the oxidising agents studied in this and the earlier papers, the oxidation of hydrazine, with special reference to the formation of azoimide and ammonia, seems to proceed in three different ways. (1) With formation of fairly large quantities of azoimide and ammonia, as effected by hydrogen peroxide, potassium chlorate, and potassium persulphate in acid solution. (2) With formation of little or no azoimide, but large amounts of ammonia, as effected by potassium permanganate, manganese dioxide, and ferric oxide in presence of sulphuric acid. (3) With formation of little or no azoimide or ammonia, as effected by potassium iodate, mercuric oxide, and mercuric chloride. It is suggested that in the first case an intermediate condensation product is formed, such as "buzylene," $NH{:}N{\cdot}NH{\cdot}NH_2$, or "aminotri-imide,"  $NH_2{\cdot}N{<}\overset{NH}{\underset{NH}{|}}$, which decomposes with formation of azoimide and ammonia, thus: $2N_2H_4 + O_2 = N_4H_4 + 2H_2O$ and $N_4H_4 = N_3H + NH_3$. In the second case, it is suggested that an intermediate product, such as "tetrazone," $NH_2{\cdot}N{:}N{\cdot}NH_2$ is formed, which breaks up into nitrogen and ammonia, thus: $2N_2H_4 + O_2 = N_4H_4 + 2H_2O$ and

$$N_4H_4 + H_2O = N_2 + 2NH_3 + O.$$

Oxidising agents of the third class seem to decompose hydrazine sulphate in acid solution at 100° without formation of intermediate condensation products.

The following is a list of the principal oxidising agents, arranged in the order of the maximum yield of azoimide obtained with each. Potassium persulphate, 40·3%; hydrogen peroxide, 38·5%; potassium chlorate, 22·4%; potassium perchlorate, 22·4%; vanadium pentoxide, 13·6%; potassium bromate in presence of silver sulphate, 11·7%; potassium iodate in presence of silver sulphate, 11·2%; potassium bromate, 6·68%; lead dioxide, 4·10%; potassium permanganate, 3·19%; manganese dioxide, 2·32%.

The preparation of azoimide can be satisfactorily accomplished by the action of hydrogen peroxide on hydrazine sulphate, but a better yield can be obtained by Thiele's method (Abstr., 1908, ii, 940). The detection of hydrazine is readily effected by converting it into azoimide by a convenient oxidising agent, and identifying the azoimide by means of the ferric chloride test (Dennis and Browne, Abstr., 1904, ii, 558). When very small amounts of hydrazine are to be detected, Thiele's method of oxidation, involving the use of ethyl nitrite, is recommended.

Attention is drawn to some analogies between the behaviour of hydrazine and of some of its organic derivatives when treated with various oxidising agents. E. G.

Formation of Oxygen Compounds of Nitrogen and of their Metallic Salts (Iron and Lead) in the Production of Ozone for the Sterilisation of Water. EDMOND BONJEAN (*Compt. rend.*, 1909, 148, 1765—1766).—In some plants which have been put down for the sterilisation of water by means of ozone, iron and lead have been used in the ozonisers and tubes leading from them. The author has found large quantities of a mixture in varying proportions of ferric oxide and nitrate in such plants, and from the analysis of samples collected at different places between the ozonisers and the water to be sterilised, he concludes that the following reactions take place: Ferric oxide is first formed in the ozonisers; being in the form of a very fine powder it favours the formation and then the fixation of oxides of nitrogen in the tubes leading from the ozonisers. The greater the distance from the ozonisers the more pronounced is the oxidation of the oxides of nitrogen to nitric acid and the more the metal of the tubing (iron or lead) is attacked, with the formation of ferric nitrate or lead nitrate. These products may cause a stoppage in the tubes, and if they are carried into the water to be sterilised, serious consequences may result to the consumers of the water.

T. S. P.

Concentration of Hydrogen Ions in Dilute Solutions of Phosphoric Acid, Monosodium Phosphate, and Disodium Phosphate. Wilhelm E. Ringer (*Chem. Weekblad*, 1909, 6, 446—452. Compare Ringer, this vol., ii, 309).—The results of a number of determinations of the concentration of hydrogen ions in dilute solutions of phosphoric acid, monosodium phosphate, and disodium phosphate are given. A. J. W.

Ionisation Relations of Ortho- and Pyro-phosphoric Acids and their Sodium Salts. G. A. Abbott and William C. Bray (*J. Amer. Chem. Soc.*, 1909, 31, 729—763).—This investigation was undertaken with the object of obtaining a knowledge of the ionisation relations of ortho- and pyro-phosphoric acids, and thus elucidating the behaviour of these acids in inorganic reactions. A summary is given of previous work on the subject.

Methods are described for the preparation and analysis of solutions of the pure acids and their sodium and ammonium salts. The conductivity of solutions of various concentrations of the acids and their sodium salts and also of ammonium disodium phosphate have been determined at 18° and the results are tabulated.

Measurements of the hydrolysis of the ammonium phosphates and pyrophosphates, $Na_2(NH_4)PO_4$, $Na(NH_4)HPO_4$, $Na_3(NH_4)P_2O_7$, $Na_2(NH_4)_2P_2O_7$, and $Na_2(NH_4)HP_2O_7$, have been made by means of distribution experiments, the method being based on the fact that when aqueous ammonia is shaken with chloroform, the ammonia distributes itself between the two solvents in a ratio which is constant at a given temperature. From the results thus obtained, the ionisation constants of the successive hydrogen atoms of ortho- and pyro-phosphoric acids were calculated on the assumption that all the salts were completely dissociated, and the values were afterwards corrected for the effect of non-ionised substances present in the solutions. The final values obtained are as follows. Ortho-phosphoric acid: $H_2PO_4^{-} + H^{+2}$, $1{\cdot}1 \times 10^{-2}$; $HPO_4^{--} + H^{+}$, $1{\cdot}95 \times 10^{-7}$; $PO_4^{---} + H^{+}$, $3{\cdot}6 \times 10^{-13}$. Pyrophosphoric acid: $H_3P_2O_7^{-} + H^{+2}$, $1{\cdot}4 \times 10^{-1}$; $H_2P_2O_7^{--} + H^{+2}$,

$1 \cdot 1 \times 10^{-2}$; $HP_2O_7^{---} + H^+$, $2 \cdot 9 \times 10^{-7}$; $P_2O_7^{----} + H^+$, $3 \cdot 6 \times 10^{-9}$.

From these results it is evident that ortho-phosphoric acid, with reference to the first equivalent of hydrogen, behaves as a fairly strong acid; with reference to the second hydrogen, it behaves as a weak acid, intermediate between carbonic acid and hydrogen sulphide, and with reference to the third, like a very weak acid, intermediate between the acid radicles HCO_3^- and HS^- of the two acids mentioned. These facts are in harmony with the heats of neutralisation and with the behaviour of the acid towards indicators.

Pyrophosphoric acid, with reference to the first hydrogen equivalent, is a strong acid, but not quite so strong as hydrochloric or nitric acid. The ion $H_3P_2O_7^-$ is somewhat weaker, its ionisation constant being almost identical with that of ortho-phosphoric acid at the same ion-concentration. The ion $H_2P_2O_7^{--}$ is a weak acid of almost the same strength as the phosphate ion, $H_2PO_4^-$, whilst the ion $HP_2O_7^{---}$ is still weaker, but not so weak as the phosphate ion, HPO_4^{--}. These facts are in agreement with the behaviour of the acid towards indicators.

The relation of these results to the molecular structure of the acids is discussed. By means of the ionisation constants, corrected values have been obtained for the conductivities of the salts, and these are presented in tabular form together with the limiting conductivity at zero concentration and the percentage of ionisation at different concentrations. It is shown that the equivalent conductivity of the ions is proportional to their valency, and that the ionisation values for the salts studied are in accord with the principles that, at the same concentration, the ionisation is approximately the same for all salts having the same valency product, and that the non-ionised fraction is greater the greater the value of the valency product. E. G.

Rate of Hydration of Pyrophosphoric Acid in Aqueous Solution. G. A. ABBOTT (*J. Amer. Chem. Soc.*, 1909, 31, 763—770). —In aqueous solution, pyrophosphoric acid is unstable, and gradually changes into ortho-phosphoric acid. This change is greatly accelerated by rise of temperature, and, at 100°, in a 0·05 formular solution is practically complete in about two hours. This hydration is accompanied by a marked decrease in the conductivity of the solution, and the rate of change can therefore be determined by conductivity measurements.

A series of determinations has been made by measuring the changes of conductivity of a 0·05 formular solution at 75° and 100°, and of a 0·0125 formular solution at 75°. The measurements were made in the platinum-lined steel bomb devised by Noyes and Coolidge (Abstr., 1904, ii, 226) for investigating the conductivity of aqueous solutions at high temperatures. In order to discover the law governing the rate of hydration of the acid, the velocity constant (specific reaction rate) was calculated (1) on the assumption that the hydration is proportional to the hydrogen-ion concentration as well as to that of the unchanged pyrophosphoric acid, and (2) on the assumption that the rate is independent of the hydrogen-ion concentration and proportional only to the concentration of the pyrophosphoric acid. The results indicate that the hydration of the acid in dilute aqueous solution takes place at a rate which is approximately proportional to its own concentration, and which increases with that of the hydrogen ion in the solution, but not nearly so rapidly as proportionality would require.

The actual rate of the reaction is approximately as follows. A 0·0125 formular solution at 75° is hydrated to the extent of 25% in 88 minutes, 50% in 220 minutes, and 75% in 470 minutes. A 0·05 formular solution at 75° is hydrated to the extent of 25% in 52 minutes, 50% in 135 minutes, and 75% in 290 minutes, whilst, at 100°, a solution of the same strength is hydrated to the extent of 25% in 5 minutes, 50% in 12·5 minutes, and 75% in 27 minutes. From the results for the 0·05 formular solution, it is evident that the rate is 10·6 times as great at 100° as at 75°. From the general principle, $\log(k_{t_2}/k_{t_1}) = \text{const.} \times (t_2 - t_1)$, it follows that at 25° and 0° the rate would be $1/(10{\cdot}6)^2$ and $1/(10{\cdot}6)^3$ as great respectively as at 75°, and that the time required to produce 25% hydration in a 0·05 formular solution would therefore be about 100 hours at 25° and 1030 hours at 0°. It also follows that the rate of the reaction increases 2·57 times for each 10° rise of temperature.

E. G.

Ordinary Carbon. Henri Le Chatelier and S. Wologdine (*Compt. rend.*, 1909, **148**, 1715—1718).—Owing to the fact that different kinds of ordinary carbon possess different heats of combustion and different densities, it has been supposed that they are really different allotropic modifications. The authors, in continuation of their work on graphite (Abstr., 1908, ii, 177), have examined various kinds of ordinary carbon to see if they contained the graphitic modification, the presence of which in varying amounts would account for results hitherto obtained.

Acetylene-black and retort-carbon were found to contain graphite, whilst lamp-black, sugar-carbon, wood-charcoal, and the filaments of incandescent lamps were found to be free from graphite.

The conclusion is drawn that there is only one kind of ordinary carbon, the density of which is approximately 1·8; a lower density is due to the presence of occluded gas. Varieties of carbon which contain graphite have a density decidedly higher than 1·8. T. S. P.

Inertness of Adsorbed CO_3''-Ions. Paul Rohland (*Zeitsch. Chem. Ind. Kolloide*, 1909, **5**, 33—35).—When cement is digested with solutions of carbonates or hydrogen carbonates, these are taken up from the solution by the cement. On treating this with dilute hydrochloric acid, no carbon dioxide is evolved, and this is attributed to the adsorption of the carbonate ions. On the other hand, carbon dioxide is immediately liberated by the action of concentrated hydrochloric acid. If a solution of ammonium carbonate is used instead of the alkali metal carbonates, carbon dioxide is set free when the cement is digested with a dilute (2*N*) hydrochloric acid solution.

H. M. D.

Silicon Chlorides. Adolphe Besson and L. Fournier (*Compt. rend.*, 1909, 149, 34—36. Compare this vol., ii, 399).—The silicon chlorides obtained by the action of an electric discharge on silicochloroform are of the saturated series, so that the action which occurs in an atmosphere of hydrogen or of hydrogen chloride is accompanied by a liberation of hydrogen and hydrogen chloride. The fraction of the product intermediate between Si_2Cl_6 and Si_3Cl_8 shows, however, an undoubted deficit of chlorine, and may contain small quantities of unsaturated chlorides. The mixture of chlorosilicomethane and dichlorosilicomethane obtained by acting on amorphous silicon with hydrogen chloride (this vol., ii, 398), when submitted to the electric discharge, seems to give the same mixture of saturated compounds instead of unsaturated substances. Seemingly excess of hydrogen chloride acts on unsaturated silicon chlorides with liberation of hydrogen. By the action of the electric discharge on hydrogen and silicon tetrachloride, a mixture of saturated silicon chlorides is produced, which are, however, present in proportions differing from those in the mixture described previously.

The substance boiling at about 150°/15 mm., described as dodecachlorosilicopentane is now found to be *decachlorosilicobutane*, Si_4Cl_{10}, with b. p. 149—151°/15 mm.

Dodecachlorosilicopentane, Si_5Cl_{12}, boils at about 190°/15 mm., and is an extremely viscous liquid. A glassy, yellow residue, stable at 200°, is a mixture containing perhaps some unsaturated chlorides.

R. J. C.

Curious Property of Neon. J. Norman Collie (*Proc. Roy. Soc.*, 1909, 82, *A*, 378—380).—When neon is shaken in a tube with mercury, a red glow is observed, which is as bright at a pressure of 120—200 mm. as when the gas is at atmospheric pressure. Most of the tubes lose their property of glowing after long-continued shaking, but regain it when a spark is passed. By unequal heating, or passing mild or violent discharges through them, tubes were obtained glowing in certain parts and not in others. There is no glowing in the presence of traces of moisture; carbon monoxide diminishes the glow, but traces of hydrogen have very little effect. The glow is even more intense in a silica tube than in a glass tube. G. S.

Actinium and Ionium. Béla Szilárd (*Le Radium*, 1909, 6, 80). —Methods are described which demonstrate that the elements ionium and actinium occur simultaneously in many of the uranium group of minerals in the absence of thorium. Their reactions are described both in the absence and presence of other rare earths. F. M. G. M.

Electrolytic Preparation of Amalgams of the Alkali and Alkali-earth Metals. George McP. Smith and H. C. Bennett (*J. Amer. Chem Soc.*, 1909, 31, 799—806).—A method is described for preparing amalgams of the alkali and alkali-earth metals by the electrolysis of a salt solution with a mercury cathode. The process is simpler and less laborious than that of Kerp and Böttger (Abstr., 1900, ii, 656) and yields better results.

Mercury is placed in a beaker and brought into contact with a platinum wire fused into the end of a glass tube; the latter contains a little mercury, into which the negative wire of the circuit dips. The mercury is covered with the solution to be electrolysed. The anode consists of a piece of heavy platinum foil so arranged that the surface immersed is parallel to that of the mercury.

Experiments on the preparation of amalgams of cæsium, rubidium, potassium, sodium, lithium, barium, strontium, and calcium are described. In several instances the amalgams obtained were found to contain a larger proportion of the alkali-metal than the corresponding amalgams obtained by Kerp and Böttger (*loc. cit.*). Thus the solid lithium amalgam contained 0·875% of lithium, corresponding with $LiHg_4$, whilst Kerp and Böttger's contained only 0·70%, corresponding with $LiHg_5$. E. G.

Hydrates of Potassium Carbonate. Robert de Forcrand (*Compt. rend.*, 1909, **148**, 1731—1734).—Although six different hydrates of potassium carbonate have been described, the only one of which the existence is certain is the hydrate $K_2CO_3,1·5H_2O$. The author has consequently taken up the study of these compounds, and in the present communication gives data relative to the hydrate above mentioned ($1·5H_2O$).

This hydrate is produced by the evaporation of a saturated solution at all temperatures between 10° and 75°. The presence of a little free potassium hydroxide or of the hydrogen carbonate has no influence on the result. In some cases crystals, which were dry at their surfaces, gave water of crystallisation varying from 1·62 to 1·99 H_2O, but this was shown to be due to the presence of occluded mother liquor. Dehydration in a current of inert dry gas gives the anhydrous salt without the formation of intermediate hydrates. The heats of solution at 15° of K_2CO_3, $K_2CO_3,1·5H_2O$, and of a saturated solution of potassium carbonate ($K_2CO_3 + 7·2H_2O$) were found to be 6·382, $-0·654$, and $-0·020$ Cals respectively. The conclusion is drawn that anhydrous potassium carbonate is a powerful desiccating agent, but that this is not true of the hydrate with $1·5H_2O$.

In one experiment the hydrate with $2H_2O$ was obtained; on dehydration it gave the hemihydrate ($0·5H_2O$). T. S. P.

The 4/3 Sodium Carbonate. Josef Habermann and A. Kurtenacker (*Zeitsch. anorg. Chem.*, 1909, **63**, 65—68).—When a solution of sodium hydrogen carbonate is evaporated at its boiling point in a current of air, an impure salt crystallises. When dissolved in hot water and 96% alcohol added until turbid, the normal carbonate first separates, and on repeating the treatment, pure crystals of the 4/3 carbonate, $Na_2CO_3,NaHCO_3,2H_2O$, are obtained. The same product results when carbon dioxide is led into the boiling solution of sodium carbonate. Sodium sesquicarbonate, $Na_2CO_3,2NaHCO_3$, is not obtained under any conditions, and it appears that the salt,

$$Na_2CO_3,NaHCO_3,2H_2O,$$

is the only stable one.

Under similar conditions, potassium carbonate only yields mixtures of the salts K_2CO_3 and $KHCO_3$. C. H. D.

The Binary Systems of Sodium Metasilicate with Lithium, Magnesium, Calcium, Strontium, and Barium Metasilicates, of Lithium Metasilicate with Potassium, Magnesium, Calcium, Strontium, and Barium Metasilicates, and the Ternary System Na_2O–Al_2O_3–SiO_2. ROBERT C. WALLACE (*Zeitsch. anorg. Chem.*, 1909, 63, 1—48).—The tendency of silicates to solidify as a glass is an obstacle to their investigation by thermal analysis. Lithium metasilicate, however, crystallises well on cooling. Carbon tubes are used for fusing the mixtures, the thermocouple being protected by a porcelain tube coated with graphite.

Several of the systems examined form a continuous series of solid solutions, the freezing-point curve having a pronounced minimum. These are Na_2SiO_3–$SrSiO_3$, Na_2SiO_3–$BaSiO_3$, and Na_2SiO_3–Li_2SiO_3. The crystallisation interval appears to be very small in all cases, so that the solidus curve lies close beneath the liquidus. All the mixtures form homogeneous, monoclinic crystals.

Mixtures of Na_2SiO_3 with 20—80% $MgSiO_3$ solidify only as glasses. The two ends of the series consist of solid solutions. Potassium metasilicate cannot be crystallised; its mixtures with 60—100% Li_2SO_3 form solid solutions.

In a second group of mixtures, two series of solid solutions are formed, separated by a gap, so that the freezing-point curve has a well marked eutectic point. This group includes the mixtures Li_2SiO_3–$CaSiO_3$, Li_2SiO_3–$MgSiO_3$, Li_2SiO_3–$BaSiO_3$, and Li_2SiO_3–$SrSiO_3$. The eutectic arrests are well marked on the cooling curves. The microscopic appearance is in accord with the thermal observations. The molecular volume is only a linear fuuction of the composition within the limits of the gap between the solid solutions; curved lines are obtained outside these limits.

In the ternary system Na_3O–Al_2O_3–SiO_2 the solid phases observed are corundum (Al_2O_3), sillimanite (Al_2SiO_5), nepheline ($NaAlSiO_4$), and sodium metasilicate. Sodium silicate forms solid solutions with silica up to at least 20% of the latter. The molten products are highly viscous, and it is impossible to say whether complete miscibility occurs in the solid state, as glasses are always formed (compare Kultascheff, Abstr., 1903, ii, 545). Mixtures corresponding with $NaAlO_2$ melt at 1800° by the Wanner pyrometer, and form crystals isomorphous with corundum. The crystals are only very sparingly soluble in water. Mixtures of silica and alumina are infusible at 1900° if containing more than 70% Al_2O_3. All the mixtures of this series correspond with sillimanite (compare Stein, Abstr., 1907, ii, 763). The melting point of sodium metasilicate is lowered by addition of sodium aluminate, a mixture with 10% $NaAlO_2$ crystallising at 960°; further additions give very infusible mixtures, forming glasses on cooling. Nepheline forms solid solutions with at least 50% $NaAlO_2$; nepheline and sodium silicate form very viscous masses. Both nepheline and silliminate crystallise from mixtures of $NaAlO_2$, SiO_2, and Al_2O_3, contrary to Morozewicz's conclusion (Abstr., 1899, ii, 762).

In the ternary diagram, a large area of mixtures, rich in silica, represents only glasses. The other fields have been mapped with reference to the solid phases which separate.

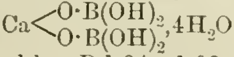
When thin plates of albite or nepheline glasses are heated with sodium tungstate at 950°, crystallisation sets in, but only to a minute depth, the interior of sections 0·05 mm. thick remaining glassy. The velocity of crystallisation of albite glass at 950° is 0·008 mm. per hour, and only 0·01 mm. per hour after heating with sodium tungstate. It is therefore only the surface crystallisation which is accelerated by the mineralising agent. C. H. D.

Forms of Matter. II. P. P. von Weimarn (*Zeitsch. Chem. Ind. Kolloide,* 1909, 5, 62—68. Compare this vol., ii, 306).—Observations are recorded which show that microcrystalline precipitates of metallic silver are obtained from silver hydrosols. In agreement with previous experiments on barium sulphate and aluminium hydroxide, the smallest particles of silver tend to increase in size and form definitely crystalline aggregates.

Silver hydrosol reacts with solutions of acids, bases, and salts, and the reaction is supposed to take place in two stages. In the first of these, hydrogen is set free, and this reacts with dissolved oxygen to form water in the second stage according to the equations: (1) $Ag + HCl = AgCl + H$ or $Ag + NaCl + H_2O = AgCl + NaOH + H$, and (2) $2H + O = H_2O$. The various special reactions studied by the author indicate clearly that silver in extremely finely divided condition is very much more active than the ordinary form of metallic silver.
H. M. D.

So-called Electrolytic Peroxide of Silver. Georg Baborovský and Gottlieb Kužma (*Zeitsch. physikal. Chem.,* 1909, 67, 48—63. Compare Abstr., 1908, ii, 378).—Silver peroxide was prepared by electrolysis of solutions of silver nitrate and of silver sulphate, and its composition was determined by direct and indirect analysis. A platinum dish was used as anode, a platinum spiral as cathode, and the anode and cathode compartments were separated by a porous cell. The amount of silver and of nitric acid in the peroxide, as well as the free nitric acid formed and the silver remaining in the anode liquid, were determined by analysis, and the active oxygen was determined in the precipitate directly as well as indirectly by inserting a voltameter in the circuit. Similar experiments were made with solutions of silver sulphate.

When the assumption is made that the small amount of nitrate in the precipitate is present as silver nitrate, the results indicate that the peroxide present has the formula Ag_3O_4. The composition of the "peroxide" as given by Šule (Abstr., 1897, ii, 98; 1900, ii, 595) is Ag_7NO_{11}, but when the above assumption is made as to the mode of combination of the nitrogen, the results in this case also are best represented by the formula Ag_3O_4. G. S.

Calcium Monoborates. R. Mandelbaum (*Zeitsch. anorg. Chem.,* 1909, 62, 370—382).—When calcium hydroxide is added, little by little, to an equivalent quantity of boric acid in solution, and the mixture is warmed at 60—70°, the precipitate at first formed is amorphous, and has, approximately, the composition $CaO,B_2O_3,4H_2O$. When the shaking at 60—70° is continued for several days, and the mixture is kept, the precipitate becomes crystalline, and has the composition of a pure monoborate hexahydrate, $CaO,B_2O_3,6H_2O$. Two-thirds of the water is driven off at 105°, the remaining water being lost only at a red heat. This indicates the formula  $Ca{<}\begin{matrix}O\cdot B(OH)_2\\ O\cdot B(OH)_2\end{matrix},4H_2O$ for the hexahydrate. The amorphous compound has D 1·84—1·92, the crystalline, D 1·822.

For the analysis, the boric acid was estimated by the author's method (this vol., ii, 701), and the calcium either by weighing as sulphate after expelling the boron with hydrofluoric acid, or by warming with an excess of *N*/5-hydrochloric acid and titrating with sodium hydroxide, using methyl-orange as an indicator. The water could only be estimated by covering the salt with ignited lead oxide and heating to dull redness in a combustion tube in a current of dry air, the water being collected and weighed.

Determinations of the solubility and hydrolysis of the two borates at different temperatures indicate that the conversion of the tetra- into the hexa-hydrate begins at 42°, and reaches a maximum at about 65°. C. H. D.

Some Double Sulphates of Calcium. BARRE (*Compt. rend.*, 1909, **148**, 1604—1606).—The author has measured the solubility at different temperatures of calcium sulphate in solutions of ammonium sulphate and potassium sulphate, and has demonstrated the existence of the double sulphates: $CaSO_4,(NH_4)_2SO_4,H_2O$; $2CaSO_4,(NH_4)_2SO_4$; $CaSO_4,K_2SO_4,H_2O$. In each case two series of measurements were made, the solid phases being respectively the double salt and the sulphate of ammonium or potassium, and the double salt and calcium sulphate; the temperature varied from 0° to 100°.

The solubility of calcium sulphate is considerably increased in the presence of ammonium sulphate. The double sulphate,

$$CaSO_4,(NH_4)_2SO_4,H_2O,$$

is stable between 0° and 100° in the presence of an excess of ammonium sulphate; it is not formed if the solution contains less than 35% of ammonium sulphate. The double salt, $2CaSO_4,(NH_4)_2SO_4$, is formed in the presence of an excess of calcium sulphate and at temperatures above 80°.

Calcium sulphate is less soluble in a solution of potassium sulphate than in water. The double sulphate, $CaSO_4,K_2SO_4,H_2O$, is stable between 0° and 99° in the presence of an excess of either of the component salts. In the given temperature interval the double sulphate, $2CaSO_4,K_2SO_4,3H_2O$ (compare Ditte, Abstr., 1877, i, 440), does not exist. T. S. P.

Parallel Growths of Different Substances. STEFAN KREUTZ (*Min. Mag.*, 1909, **15**, 232—237. Compare Abstr., 1908, ii, 366).—Parallel growths were obtained of sodium nitrate on barytocalcite

($BaCaC_2O_6$) and of lithium nitrate on the rhombohedral carbonates, rhodochrosite and chalybite. The molecular volumes and topic axes of these substances are compared. L. J. S.

Solid Solution: The Retention of Aluminium by Barium Sulphate Precipitates. Henry Jermain Maude Creighton (*Zeitsch. anorg. Chem.*, 1909, **63**, 53—58).—Precipitates produced from ammonium sulphate and barium chloride in presence of aluminium chloride retain aluminium. The retained quantity, measured by the excess weight of the precipitate over that calculated, increases with the quantity of aluminium chloride present until a constant value is reached. With a constant quantity of aluminium chloride, it increases with the quantity of ammonium sulphate. The results indicate the formation of a solid solution, and not of a compound. C. H. D.

Magnesium Oxychlorides. Hans Hof (*Chem. Zeit.*, 1909, **33**, 693—694. Compare Abstr., 1908, ii, 946).—The author prepares magnesium oxychloride by electrolysing, with the use of a diaphragm, a strong solution of magnesium chloride until magnesium hydroxide appears in the cathode liquid. The filtered solution, after some twenty-four hours, deposits a white mass, which is cautiously washed with absolute alcohol and then with ether. The analysis agrees fairly well with the formula $MgCl_2,5MgO,14H_2O$.

Dried over sulphuric acid it loses $3H_2O$, and on heating at 180° $8H_2O$, thus yielding a product of the formula $MgCl_2,5MgO,6H_2O$.

When, according to Bender, freshly ignited magnesium oxide is mixed with excess of magnesium chloride solution and the powdered, hardened mass extracted with absolute alcohol, avoiding a too long contact, the residual mass consists of $MgCl_2,5MgO,13H_2O$, of which $8H_2O$ are expelled when dried at 180°. If magnesium chloride is mixed with excess of magnesium oxide and the powdered mass exposed to the action of carbon dioxide, the excess of magnesium is gradually carbonated, but the MgO of the oxychloride is also attacked to some extent, and in an experiment mentioned by the author the proportion between magnesium chloride and oxide was as 1 to 4·4. L. de K.

Action of Soluble Substances on Insoluble Substances. William Oechsner de Coninck (*Bull. Acad. Roy. Belg.*, 1909, 508—509. Compare Abstr., 1908, ii, 843).—Carbonate of zinc (1 mol.) is not decomposed by sodium chloride (2 mols.) dissolved in water after exposure to diffused daylight for some weeks; in the same circumstances, cadmium carbonate is not decomposed by sodium chloride, and manganese carbonate is not acted on by sodium nitrate. Cerussite is not decomposed by boiling with a large excess of sodium nitrate for some hours, but powdered lead chromate is slightly acted on in the same circumstances. Lead iodide is slightly soluble in boiling aqueous solutions of the nitrates of sodium and potassium.

G. S.

Reactions of Some Salts. William Oechsner de Coninck (*Bull. Acad. Roy. Belg.*, 1909, 691—692).—A mixture of two molecules of sodium chloride in aqueous solution and 1 molecule of zinc carbonate was exposed to the light for five months without any reaction taking place.

Under similar conditions, manganese carbonate and sodium nitrate also did not react; the experiment lasted from January 22nd to May 26th, 1909 (compare preceding abstract). T. S. P.

Conglomerates obtained by Compressing Mixtures of the Powders of Two Metals. GUSTAV TAMMANN [with G. MASING] (*Zeitsch. Elektrochem.*, 1909, 15, 447—450).—Mixtures of two metals in the form of filings are submitted to a pressure of 5000 atmospheres and the blocks examined microscopically, and by determining their behaviour on heating and their electrical conductivity. It is found that immediately after compression, the block consists of the unchanged metals lying side by side, combination or solution then goes on slowly; for example, a mixture of lead and thallium had the conductivity corresponding with a mixture immediately after compression. This increased by about 10% in one day, and in the course of a month it had increased by 60 to 75%. The increase is much faster if the mixture is heated to 160°. The formation of mixed crystals of bismuth and thallium as a blue fringe between the metals can be seen after five hours at 120°, and at 165° another yellow line of the compound, Bi_3Tl_3, becomes visible. The change takes about a year at the ordinary temperature.

The combination or mutual solution of two metals is therefore not brought about by pressure alone, but results from subsequent diffusion in the solid state, which is, of course, very much accelerated by raising the temperature (compare following abstract). T. E.

The Formation of Alloys by Pressure and the Reactivity of Metals in the Solid State. G. MASING (*Zeitsch. anorg. Chem.*, 1909, 62, 265—309).—It was found by Spring (Abstr., 1881, 498; 1882, 273; 1882, 921; 1893, ii, 168; 1895, ii, 37) that filings of different metals, compressed together under 7500 atmospheres, yielded masses which behaved as alloys. So far as fusible metals are concerned, it was shown by Hallock (Abstr., 1889, 817) that a mixture of the component metals melts slowly to form the eutectic, even without previous compression (compare also Benedicks and Arpi, Abstr., 1907, ii, 666). Pressure has, moreover, very little influence on the velocity of chemical reactions, and is not likely to increase the velocity of diffusion in solid solutions; it is therefore improbable that the formation of true alloys should occur under the influence of pressure alone.

An apparatus is described for compressing mixtures of metals under 5000 atmospheres. Heating and cooling curves were taken of each mixture after compression.

Compressed mixtures of zinc and cadmium and of copper and silver in the eutectic proportions melt at a temperature above the eutectic temperature, on account of the coarseness of grain as compared with the eutectic formed in freezing. Mixtures of magnesium with lead, tin, zinc, bismuth, and antimony, all of which are capable of forming compounds, but not solid solutions, undergo combination to some extent even in the solid state, as, on heating, partial fusion is found to take place at the lower eutectic point of each series. The reaction between antimony and magnesium begins below 300°, and becomes explosive at 450—550°.

Magnesium and cadmium, which form a continuous series of solid solutions, diffuse into one another in the solid state, so that equal weights of the two metals, after compressing and then heating twenty-five hours at 300°, do not begin to melt until 420°, that is, above the melting point of cadmium (320°).

In the case of bismuth and thallium (compare preceding abstract), which form a compound and also solid solutions, diffusion may be recognised even at the ordinary temperature. At 120° the diffusion is appreciable even in a few hours. Diffusion takes place in mixtures of lead and thallium at 200°. Diffusion of tin into copper takes place at 200°, whilst zinc and copper diffuse into each other readily at 400°. Aluminium and magnesium combine in the solid state.

The electrical conductivity may be used as a sensitive method of detecting diffusion. A compressed mass of lead and thallium is thus shown to be only a mechanical mixture, whilst heating causes a considerable fall in the conductivity, owing to the formation of a solid solution.

The effect of pressure is therefore only to bring the fragments of metal into close contact, and it has no influence in furthering either combination or diffusion. C. H. D.

The Phosphates of Lead. H. Alders and Arthur Stähler (*Ber.*, 1909, 42, 2261—2270).—Tertiary lead phosphate, $Pb_3(PO_4)_2$, when prepared by precipitating a lead salt with excess of alkali phosphate, always contains alkali, which is not removed by boiling. The pure salt is only obtained from hot sodium phosphate and an excess of lead acetate, or by boiling the diplumbic salt with water. Secondary lead phosphate, $PbHPO_4$, is obtained in a pure state by recrystallisation from dilute phosphoric acid. Primary lead phosphate, $Pb(H_2PO_4)_2$, is obtained by heating either of the other phosphates with 90% phosphoric acid, and crystallises from concentrated phosphoric acid in slender needles, which are stable in air after washing with ether. It is decomposed by water.

An investigation of the equilibrium between lead phosphates and phosphoric acid shows that the secondary salt has the greatest stable range, its formation from the tertiary salt beginning at a concentration of 0·017% H_3PO_4, whilst the formation of the primary salt only begins at 70% H_3PO_4. C. H. D.

Dimercurammonium Bromide. H. Gaudechon (*Compt. rend.*, 1909, 148, 1763—1765).—If a hot solution of mercuric bromide is poured into excess of a cold solution of ammonium hydroxide, either a white precipitate having the composition $NHg_2Br,3NH_4Br$, or else a yellow precipitate of the composition NHg_2Br,NH_4Br is obtained; on washing either of these with water, the compound NHg_2Br,H_2O is left.

On the other hand, if the ammonium hydroxide is added gradually to the warm solution of the mercuric bromide, a whitish yellow precipitate is obtained, which becomes deep yellow on prolonged washing with water to remove soluble bromides. This substance has the composition $Hg_9N_4Br_6$ or $(NHg_2Br)_4HgBr_2$. If it is repeatedly treated with warm concentrated ammonium hydroxide until no more ammonium bromide is formed, a canary-yellow product is left, which has the composition NHg_2Br. This compound will not combine with water to form the compound NHg_2Br,HO_2, neither can it be obtained from the latter by heating. When quickly heated, it explodes at a red heat, but when heated slowly, it decomposes at about 400° with the formation of mercurous bromide and mercury. It corresponds with NHg_2I, the anhydrous chloride having not yet been prepared.

T. S. P.

New Method of Isolating Terbium. GEORGES URBAIN (*Compt. rend.*, 1909, **149**, 37—39. Compare Abstr., 1905, ii, 711).—The rare earth metals may be arranged in a table according to the solubilities of their salts, but in some cases, as for instance the nitrates crystallising with $5H_2O$, the order is anomalous. Thus the nitrates of gadolinium and terbium, unlike the other salts of these metals, have solubilities which differ somewhat widely. Bismuth nitrate, $Bi(NO_3)_2,5H_2O$, is slightly less soluble in nitric acid than terbium nitrate, and more soluble than gadolinium nitrate. By adding a large excess of bismuth nitrate to the gadolinium and terbium nitrates to be separated, and by systematically crystallising for a sufficient time, complete separation of the gadolinium from the terbium is attained. The terbium obtained by this new method is identical in arc spectrum and paramagnetic coefficient with that prepared previously by laborious fractional precipitations with ammonia, thus proving the homogeneity of the element (compare Urbain and Jantsch, this vol., ii, 116).

The function of bismuth nitrate which acts as a separator, preventing the crystallisation of terbium nitrate, recalls the use of copper in the electrolytic separation of silver from lead (compare Gillett, this vol., ii, 521).

R. J. C.

The Electrical Reduction of Aluminium. FR. BOCK (*Zeitsch. angew. Chem.*, 1909, **22**, 1309—1311).—When aluminium oxide in molten cryolite is electrolysed (Hall's patent), considerable difficulty is caused by what is known as the "anode effect," namely, a rapid decrease in the amount of current, probably brought about by a film of gas developing on the graphite anode.

With the object of minimising this effect and increasing the yield of aluminium per ampere hour, experiments with different sized crucibles and various anodes have been made, and the results are recorded. The main conclusions arrived at being that the nature of the anode and also its form play an important part, and, notwithstanding the disturbing influence of the "anode effect," a satisfactory yield of aluminium may be obtained by this method. The best results were obtained when using an anode constructed of four graphite plates, 1·9 cm. × 12·5 cm. × 12·5 cm., equally spaced to fit into a crucible cathode 17·8 cm. × 17·8 cm. × 17·8 cm.; the yield of aluminium under these conditions corresponding with a current efficiency of 49% per ampere hour.

J. V. E.

Separation of Graphite From White Cast Iron Heated Under Pressure. Georges Charpy (*Compt. rend.*, 1909, 148, 1767—1769).—When white cast iron is annealed at temperatures which need not exceed 600—700°, the carbon separates in the form of graphite. The author has investigated whether this action takes place when the iron is submitted to high pressures during the heating.

A special apparatus, made of steel was used, in which the alloys of iron and carbon under investigation could be heated electrically to temperatures varying between 600° and 1200°, and under pressures which in some cases were as high as 15,000 atmospheres. Pressure was put on the alloys while cold until no further diminution in volume took place, and then they were electrically heated; at a certain temperature a diminution in volume took place, and had to be compensated by increasing the pressure.

When a white iron containing 3% of carbon and 4% of nickel, or one containing 3% of carbon and 2% of silicon, was heated at 1100° under a pressure of 150 kilograms per sq. mm. (15,000 atmospheres) until the above-mentioned diminution in volume took place, graphite was found to be present after cooling. The longer the heating the greater the proportion of graphite.

Similar results were obtained when carbide of iron (Fe_3C) was used instead of white iron. T. S. P.

Genetic and Constitutive Relations in the Magnetic Properties of Ferrites and of Iron Oxides. Siegfried Hilpert (*Ber.*, 1909, 42, 2248—2261).—The number of compounds having marked magnetic permeability is very small, consisting chiefly of compounds derived from ferric oxide. The author has examined a number of ferrites of the general formula MO,Fe_2O_3, observing the approximate temperature at which the permeability disappears.

Crystalline sodium and potassium ferrites, prepared in the wet way, are indifferent in a strong magnetic field. Prepared by fusion, they are slightly magnetic, losing this property at 150°. Calcium and barium ferrites, prepared in the wet way, are non-magnetic unless heated to 800° and cooled. Calcium ferrite, prepared by fusion, melts at 1200° and has a transformation point at 160°. Magnesium, zinc, and lead ferrites are also non-magnetic until fused. The transformation point of lead ferrite is near 200°. Cuprous ferrite, prepared by fusion in nitrogen at 1250°, is crystalline, and is only slightly magnetic. Precipitated cupric ferrite is magnetic. It becomes crystalline at 900°, and may be obtained in compact masses by compressing a mixture of cupric and ferric oxides and sintering at 1000°. The transformation point is at 280°. Precipitated cobaltic ferrite loses its magnetic properties at 280—290°.

A mixed lead and cupric ferrite is as strongly magnetic as pure cupric ferrite if rapidly cooled from 1000°, but loses this property if slowly cooled, or if melted at 1300°. The permeability is restored by heating to 900° and slowly cooling.

Ferric hydroxide, prepared by oxidising freshly precipitated ferrous hydroxide with ammonium persulphate, is non-magnetic, but if first oxidised by air to the Fe_3O_4 stage, the persulphate gives a highly magnetic product, becoming changed into ordinary ferric oxide at or above 400°. A cobaltic ferrite prepared in the same way is also magnetic.

The ferric hydroxide obtained by the action of air on ferrous carbonate is non-magnetic if rapidly prepared, but if oxidised slowly, so that ferroso-ferric oxide is first formed, the final product is magnetic.

The magnetic ferrites all contain Fe_2O_3 as an acid-forming oxide, and it is probable that the magnetic ferric oxides described also retain the same constitution: $2(FeO)^+ + 2(Fe_2O_3)^- + O = (Fe_2O_3)^+,2(Fe_2O_3)^-$, this molecular arrangement, however, being unstable, and lost on heating. C. H. D.

Uranyl Chloride. William Oechsner de Coninck (*Compt. rend.*, 1909, **148**, 1769—1770).—A solution of barium chloride is added drop by drop to a freshly prepared and concentrated solution of uranyl sulphate until all the sulphuric acid is precipitated. Evaporation of the filtrate on the water-bath gives a yellow, deliquescent mass, consisting of uranyl chloride, UO_2Cl_2; hydrated crystals,

$$UO_2Cl_2,H_2O,$$

can also be obtained.

Reduction of the chloride by hydrogen, under the influence of heat, gives the black modification of uranous oxide. If the chloride is fused with a large excess of potassium hydroxide in an open tube, the red peruranate, K_2UO_5, is produced; this gradually loses oxygen with the formation of the yellow uranate, K_2UO_4.

The addition of excess of concentrated ammonium hydroxide to a solution of uranyl chloride containing a small quantity of barium chloride at once gives a deep yellow precipitate of barium uranate, $BaUO_4$. T. S. P.

Peruranic Acid. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 692).—A 12-volume solution of hydrogen peroxide was added in small portions at a time to a dilute solution of a mixture of uranous and uranic sulphates. A bright yellow precipitate was formed; after remaining in contact with the solution for forty-eight hours in the dark, it was washed until neutral, and then dried over sulphuric acid. Analysis showed it to be a peruranic acid of the formula $UO_4,2H_2O$. T. S. P.

Orthopervanadates. Petr. G. Melikoff and E. Jelchaninoff (*Ber.*, 1909, **42**, 2291—2294).—In former investigations of peracids (Melikoff and Pissarjewsky, Abstr., 1899, ii, 491), ortho-salts of pervanadic and percolumbic acids were not obtained, being unstable under the conditions of experiment. The vanadium salts may be obtained by using concentrated (30%) hydrogen peroxide.

Ammonium orthopervanadate, $(NH_4)_3VO_6,2\frac{1}{2}H_2O$, is prepared by dissolving ammonium vanadate in ammonia, cooling to 0°, adding hydrogen peroxide, and precipitating with alcohol. The product, after washing with ether and drying, is pale blue.

With a large excess of hydrogen peroxide, an indigo-blue salt containing more oxygen, probably $VO_2(OH)(O{\cdot}ONH_4)_2$, is obtained.

Potassium orthopervanadate, $K_3VO_6,2\frac{1}{2}H_2O$, prepared as above, forms a blue oil, but after dissolving in a little potassium hydroxide and again precipitating with alcohol, forms a blue, flocculent precipitate. Excess of hydrogen peroxide gives an acid salt.

Only salts with two active oxygen atoms at most could thus be obtained, whilst the pertantalates readily form salts with four active atoms. C. H. D.

Influence of Temperature on the Hydrolysis of Bismuth Halides. WALTER HERZ and ALFRED BULLA (*Zeitsch. anorg. Chem.*, 1909, 63, 59—62).—The authors claim priority against Dubrisay (this vol., ii, 406), whose figures for the hydrolysis of bismuth chloride agree in the main with theirs (this vol., ii, 320). Experiments have now been carried out at 50°. As at 25°, the only solid phases formed are BiOCl and BiOBr.

The hydrolysis of bismuth chloride is lessened by rise of temperature. The ratio $[BiCl_3]/[HCl]^2$ increases somewhat at high concentrations. The hydrolysis of bismuth bromide is almost independent of the temperature. The decomposition of bismuth iodide by water at 50° is so slow that measurements of the hydrolysis could not be made. C. H. D.

Preparation of Colloidal Gold by means of Solutions of Humus. PAUL EHRENBERG and HANS PICK (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 30—31).—In 1830, Schübler found that the addition of gold chloride to a solution of humic acid gave rise to a purple-red solution. The authors find that this is due to colloidal gold, solutions and suspensions of different colours being obtained under different conditions. In sunlight the action is considerably accelerated, but this is due to the rise of temperature, and not to any special actinic effect. H. M. D.

Rhodium. ALEXANDER GUTBIER and L. VON MÜLLER (*Ber.*, 1909, 42, 2205—2207. Compare this vol., ii, 523).—Rhodium may be separated readily from the halogens in such compounds as chloropentamminerhodium chloride by heating a hot dilute aqueous solution of the compound with a slight excess of 10% hydrazine hydrate solution. A rhodium mirror is produced, and this, on subsequent boiling, becomes detached as small, glistening flakes, which can be filtered easily. The halogen can be estimated in the filtrate in the usual manner. J. J. S.

Mineralogical Chemistry.

Gas from Volcanic Fumerolles. ARMAND GAUTIER (*Compt. rend.*, 1909, 148, 1708—1715).—As a result of his researches on the gases extracted from various rocks and on the origin of these gases

(Abstr., 1901, ii, 171, 322, 399; 1903, ii, 222), the author has formulated a new theory of volcanic phenomena (Abstr., 1906, ii, 538, 548). He has now analysed gases collected from the fumaroles of Vesuvius at different times, with the following results.

I. Gas collected from a fumarole not far from the summit of the cone, three months after the eruption in April, 1906.

II. Gas collected from fumaroles in October, 1907, eighteen months after the eruption:

	HCl.	CO_2.	CO	H.	O.	N (argon etc.).	H_2O.
I.	0·78	11·03	nil.	1·24	3·72	15·49	67·74
II.	Nil.	0·80	0·15	0·54	4·59	21·23	72·69

The following gases were not present: carbon monoxide, hydrocarbons, oxides of nitrogen, sulphur dioxide, hydrogen sulphide, hydrogen fluoride, fluorides of silicon and boron. There was no deposit of sulphur. A trace of formic acid was noticed. Carbon oxysulphide was very carefully searched for, but never found.

Other samples of gas collected at the same date gave similar results.

The gases, II, issuing from the fumaroles rapidly attack steel or copper, although they do not contain hydracids. They have an odour recalling that of bromine or chlorine. T. S. P.

The Optical Rotatory Power of Mineral Oils, Etc. Franz Henle (*Ber.*, 1909, 42, 2453—2454).—Polemical in regard to the paper by Rakusin (this vol., ii, 586). P. H.

Metallic Sodium as the Supposed Cause of the Natural Blue Colour of Rock-salt. Giorgio Spezia (*Centr. Min.*, 1909, 398—404. Compare Abstr., 1908, ii, 396).—Since a blue colour may be produced artificially in rock-salt by heating it in sodium vapour, it has been suggested by H. Siedentopf (Abstr., 1906, ii, 443) that the blue colour is due to the presence of metallic sodium in a colloidal state, in the same way that the colour of red glass is due to the presence of colloidal gold. Several comparative experiments made by the author on naturally- and artificially-coloured blue rock-salt and on colourless rock-salt do not, however, support this view. When the blue salt is dissolved in water the colour disappears, and the solution, although slightly alkaline, is no more so than a solution of colourless rock-salt. The natural blue colour is destroyed at a temperature of 275°, whilst the artificially-produced colour is still retained at 400°.
L. J. S.

Formation of Delvauxite. Emil Dittler (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 35).—The author describes a light brown, sponge-like mineral found in the iron ore deposits of Grillenberg, near Payerbach, which represents one of the stages in the formation of the mineral gel delvauxite. Analysis gave 34·23% Fe_2O_3, 17·38% P_2O_5, and about 50% H_2O, as well as small quantities of sulphate and traces of arsenic; the mineral may be regarded as a precursor of delvauxite. It has the typical characters of a gel. After dehydrating by exposure to 90% sulphuric acid, it takes up water, alcohol, and very dilute sulphuric acid with great avidity, and this absorption is accompanied by a considerable increase in volume. It decolorises ammoniacal phenolphthalein solution almost immediately, and absorbs readily basic dyes. On heating the mineral for a considerable period, it loses its colloidal properties. H. M. D.

Results of the Geological and Mineralogical Exploration of Egueï. G. Garde (*Compt. rend.*, 1909, 148, 1616—1619).—Egueï is situated about 300 kilometres north-east of lake Tchad, in the desert. Four different minerals, namely, trona, thenardite, gypsum, and a phosphate of iron, have been found by the author in the clay. The phosphate of iron is either light or dark brown in colour; it is mono-refringent, but contains some parts which are birefringent. Analysis gave the following results:

P_2O_5.	Fe_2O_3.	Al_2O_3.	CaO.	H_2O.	Residue.	
33·30	44·20	1·50	2·28	20·17	0·75	= 99·50

corresponding with the formula

$$5(FeAl)_2(PO_4)_2,Ca_3(PO_4)_2,4Fe(OH)_3,21H_2O.$$

This does not correspond exactly with any known mineral. The new mineral has probably been formed from vivianite.

T. S. P.

Plumboniobite. Otto Hauser and L. Finckh (*Ber.*, 1909, 42, 2270—2274).—A new mineral related to samarskite, but containing lead, occurs in mica mines at Morogoro in the Uluguru Mountains, German East Africa, together with pitchblende. *Plumboniobite* forms dark brown or black, imperfectly crystalline masses, brown in thin sections, D^{15} 4·801—4·813, H 5—5·5, fracture conchoidal. The analyses (II) and (III) refer to light-coloured material, (I) to darker.

	Cb_2O_5.	Ta_2O_5.	TiO_2.	UO_2.	SnO_2.	ThO_2.	ZrO_2.	Y_2O_3.	Al_2O_3.	PbO.	CuO.	FeO.	MnO.
I.	46·15	1·18	1·20	13·72	0·15	0·06	trace	14·26	0·28	7·62	trace	5·70	0·11
II.	47·00		1·42	13·74	0·14	0·08	—	14·51	0·23	7·08	0·25	6·33	0·32
III.	46·03	1·20	0·90	13·60	—	—	—	14·12	0·17	7·55	1·21	5·15	0·28

	CaO.	H_2O.	N_2, He.	CO_2.	Total.
I.	3·05	6·38	0·22	0·19	100·27
II.	3·11	6·51			100·72
III.	2·84	6·23			99·89

The yttrium earths contain ytterbium and gadolinium; the cerium earths are absent. Helium is only present in very small quantity. The mineral is a pyrocolumbate. C. H. D.

Alamosite, a New Lead Silicate from Mexico. Charles Palache and H. E. Merwin (*Amer. J. Sci.*, 1909, [iv], 27, 399—401).—The mineral was found at Alamos, Sonora, Mexico, in association with quartz, cerussite, leadhillite, and wulfenite. It forms radiated fibrous aggregates with more or less pronounced spheroidal form, a snow-white colour, and adamantine lustre; isolated fibres are colourless and transparent. The crystals are monoclinic, with *a* : *b* : *c*

1·375 : 1 : 0·924 ; $\beta = 84°10'$; they are elongated in the direction of the axis of symmetry, and have a perfect cleavage parallel to the plane of symmetry. The mineral is decomposed by strong nitric acid with gelatinisation. Analyses gave results agreeing with the formula $PbSiO_3$.

SiO_2.	PbO.	CaO.	FeO.	Residue from PbO.	Insol. (quartz).	Total.	Sp. gr.
21·11	78·13	trace	0·09	0·53	0·08	99·94	6·488

The mineral is thus analogous to wollastonite ($CaSiO_3$), although, owing to the appreciable difference in the length of the a-axis and in the different cleavage, it is perhaps not isomorphous with this.

L. J. S.

The Identity of Poonahlite with Mesolite. Herbert Lister Bowman (*Min. Mag.*, 1909, 15, 216—223).—The acicular zeolite poonahlite (of H. J. Brooke, 1831), found associated with apophyllite and stilbite near Poonah, has usually been classed with scolecite. The following analysis, as well as the geometrical and optical characters, show, however, that it is identical with mesolite, with the formula:

$$(Na_2Al_2Si_3O_{10},2H_2O),2(CaAl_2Si_3O_{10},3H_2O).$$

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.	Sp. gr.
46·71	26·45	9·35	5·33	0·11	12·56	100·51	2·264—2·272

The transparent, acicular crystals have a prism angle of 88°30′49″, and a perfect prismatic cleavage. Their optical characters indicate anorthic symmetry. The double refraction is very low (0·0004), and the optic axes, with very strong axial dispersion, are nearly perpendicular to the prism faces; the needles therefore show very characteristic blue and yellow colours when examined between crossed nicols.

L. J. S.

Identity of Guarinite and Hiortdahlite. Ferruccio Zambonini [with analysis by George T. Prior] (*Min. Mag.*, 1909, 15, 247—259).—The rare Vesuvian mineral, guarinite, found as small, yellow crystals in the sanidine bombs of Monte Somma, was described by Guiscardi in 1857 as a calcium titano-silicate with orthorhombic symmetry. A later analysis by Rebuffat (Abstr., 1896, ii, 309) gave it as a complex silicate of calcium, aluminium, and sodium. A new examination of the crystals proves them to be anorthic, with interfacial angles and optical characters identical with those of hiortdahlite. A micro-chemical test showed presence of zirconium, and this suggested that the ammonia precipitate, believed by Guiscardi and Rebuffat to be titanium or aluminium, was really zirconium. The following new analysis (made on 0·3341 and 0·0612 gram of material) completely proves the identity of guarinite with hiortdahlite, the only important difference being in the amount of fluorine (5·83% in hiortdahlite):

SiO_2.	ZrO_2.	Cb_2O_5.	Ta_2O_5.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	F.	Total less O for F.	Sp. gr.
30·53	19·70	1·68	0·21	1·91	1·56	35·80	0·57	0·43	6·13	1·28	99·26	3·25

The corresponding formula is $3CaSiO_3,[Ca(F,OH)]NaZrO_3$.

L. J. S.

Labradorite-norite with Porphyritic Labradorite Crystals. Johan H. L. Vogt (*Quart. Journ. Geol. Soc.*, 1909, 65, 81—102).—A labradorite-norite from Napp Farm on Flakstadö, one of the Lofoten and Vesteraal Islands off the northern coast of Norway, consists of large porphyritic crystals of labradorite reaching 18 cm. in length, set in a ground-mass of plagioclase (61·88%), titanomagnetite (9%), hypersthene (13%), diallage (13%), biotite (3%), apatite (0·12%), and spinel (0·01%). The labradorite phenocrysts form nearly 23% of the mass of the rock, and have the composition given under I; the optical extinction angles indicate that the outer zones are slightly more acid than the central portions. Analysis II is of the still more acid plagioclase of the ground-mass; and III is of the whole of the ground-mass.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	P_2O_5.	Total.	Sp. gr.
I.	52·42	—	31·25*	—	—	—	11·98	3·44	0·97	—	100·06	2·708
II.	55·18	—	29 02†	—	—	—	10·02	4·88	1·00	—	100·10	2·685
III.	47·75	1·74	18·71	6·08	7·11	5·32	9·47	2·70	1·20	0·05	100·13	—

* Including a little Fe_2O_3 and TiO_2. † Including a very little Fe_2O_3.

The order of crystallisation was: (1) plagioclase phenocrysts; (2) plagioclase and magnetite; (3) plagioclase, magnetite, and pyroxenes. Graphic representations are given to illustrate the crystallisation of a ternary system of plagioclase, magnetite, and pyroxene with binary and ternary eutectics. L. J. S.

Sodalite-trachyte from Pico de Teyde, Teneriffe. Heinrich Preiswerk (*Centr. Min.*, 1909, 393—396).—The rock consists of laths of anorthoclase in a ground-mass of sanidine, sodalite, and glass, with some diopside, magnetite, biotite, and apatite. Analysis I, by Naima Sahlbom. Analyses are also given of: II, phonolite containing nosean and aegirite; III and IV, basalt from Teneriffe. The basalts contain a low percentage of silica with high titanium dioxide and alkalis.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	H_2O (110°).	Total.
I*.	59·46	0·45	19·49	1·45	2·30	0·24	1·66	1·05	4·34	9·34	0·26	0·21	100·63
II.	54·24	0·51	20·84	2 26	2·09	0·15	2·99	1·21	3·84	9·22	1·89	1·24	100·48
III.	42·77	3·08	15·80	3·34	10 85	0·18	9·77	9·04	1·65	3·49	0·27	0·35	100·59
IV.	41·49	3·50	16·27	3·08	8·57	0 45	11·70	8·97	1·24	3·26	0·31	0·15	99·48

* Also Cl 0·38.

L. J. S.

Crystalline Schiets of the Urals. Louis Duparc (*Compt. rend.*, 1909, 148, 1683—1685).—The crystalline schists of the northern Urals are found immediately beneath argillaceous schists of the Lower Devonian period, and above a mixture of true quartzites and conglomerates of unknown age. The crystalline schists are divisible into two distinct types, the one acidic, representing metamorphosed sediments from the quartzite, and the other, which is rarer, basic, produced by erosion and metamorphosis of the intrusive green stones which are frequently encountered. In accord with mineralogical and chemical character, the first type may be subdivided into (*a*) quartzite, (*b*) sericite quartzite, and (*c*) sericite gneiss with albite, whilst the basic type is subdivided into (*a*) albito-epidote amphibolite, (*b*) albito-chlorite schist, and (*c*) albito-epidote glaucophanite. Complete analyses are given of a typical specimen of each of these six classes of schist. R. J. C.

Physiological Chemistry.

Effect of Forced Breathing and Oxygen on the Distress Caused by Muscular Work. C. Gordon Douglas and John S. Haldane (*Proc. physiol. Soc.*, 1909, i—iv; *J. Physiol*, 39).—Forced breathing performed before violent muscular exercise lessens the subsequent distress, and lowers the respiratory quotient. This is because the carbon dioxide is washed out of the body, so that muscular work does not cause such an excess of that gas in the blood as would otherwise occur.

The previous breathing of oxygen, unless forced, has no appreciable effect, because normal breathing of oxygen has no effect on respiration, and there is no storage of oxygen so breathed in the body.
W. D. H.

Influence of Age and Size on the Gaseous Metabolism of Children. Artur Schlossmann and Hans Murchhauser (*Biochem. Zeitsch.*, 1909, 18, 499—509).—A discussion on the relationship between gaseous metabolism and the body surface. The elimination of carbon dioxide and absorption of oxygen were at three different periods proportional to the area of the surface, independently of the age of the child. W. D. H.

Method for Measuring the Loss of Water by the Organism Through the Lungs and Skin. Variation of this Loss with Altitude. H. Guillemard and Robert Moog (*Compt. rend.*, 1909, 148, 1624—1627).—The loss of water through the lungs and skin is measured indirectly by finding the total loss in weight of the body during a definite period, and by determining the composition of the gases expired during this interval. The ratio between total weight of water eliminated and total loss in weight is about 0·88 near the sea level, and somewhat less at high altitudes. W. O. W.

The Absorption of Nitrous Oxide by the Blood. Richard Siebeck (*Chem. Zentr.*, 1909, i, 18, 1491).—The absorption coefficient of water for nitrous oxide is smaller than that of blood. The increased absorption is not due to the plasma, the coefficient of which is 97·5% of that of water. On the other hand, a solution of red corpuscles has markedly greater coefficient than water, and the absorption in this solution obeys Henry's law, and is independent of the absorption of carbon dioxide and oxygen. S. B. S.

The Electrochemical Measurement of Alkalinity in Blood and Serum. Leonor Michaelis and Peter Rona (*Biochem. Zeitsch.*, 1909, 18, 317—339).—The difference of potential produced by platinum hydrogen electrodes immersed in the blood or serum and in acid or alkaline solutions of known hydrogen or hydroxyl concentration was measured, and the alkalinity of the blood thereby determined. Special forms of electrodes, suitable for small quantities of fluid, are described, by means of which equilibrium in the system is attained in a few minutes. The hydrogen-ion concentration in blood-serum was found to vary between 0·036 and $0{\cdot}20 \times 10^{-7}$, the value depending chiefly on the amount of carbon dioxide present. By passing this gas through serum, the concentration of hydrogen ions could be increased to $1{\cdot}4 \times 10^{-7}$, whilst by the passage of air it could be diminished to $0{\cdot}8 \times 10^{-9}$. The influence of temperature and of the addition of acids and alkalis on the hydrogen-ion concentration of blood and serum was also studied. S. B. S.

The Sugar of the Blood. VI. The Distribution of Sugar in the Blood in Hyperglycæmia. Leonor Michaelis and Peter Rona (*Biochem. Zeitsch.*, 1909, 18, 375—379).—In cases of hyperglycæmia, whether in diabetes or experimentally produced, the corpuscles as well as the plasma partake of the increase in sugar.

S. B. S.

The Sugar of the Blood. VII. Permeability of Blood Corpuscles for Dextrose. Peter Rona and Leonor Michaelis (*Biochem. Zeitsch.*, 1908, 18, 514—520).—In previous researches it has been shown that a considerable portion of the blood sugar is carried by the corpuscles. It is now shown that, *in vitro*, the corpuscles do not take up an excess of sugar from solutions in which they are placed. In the circulating blood, the corpuscles are permeable to dextrose; outside the body they are not. W. D. H.

Coagulation of Blood. Leo F. Rettger (*Amer. J. Physiol.*, 1909, 24, 426—435).—A discussion of current theories of coagulation, together with experiments on solutions of fibrinogen in relation to solutions of thrombin. It is doubted whether thrombin is an enzyme; it is not destroyed by boiling, and minimal amounts will not produce complete coagulation; minimal amounts produce correspondingly small clots. The existence of a proferment is regarded as unproved, and the existence of kinases or coagulins as improbable. The coagulation of the blood is a quantitative reaction, and is probably a mutual precipitation of two colloids, fibrinogen and thrombin. Thrombin appears to be a protein, but not a nucleo-protein. It will readily be understood that on this view the action of anti-thrombin, calcium salts, and decalcifying agents is interpreted on new lines, but on this and many other points this very suggestive paper cannot be advantageously summarised in a short way. W. D. H.

The Coagulation of the Blood. II. John Mellanby (*J. Physiol.*, 1909, 38, 441—503. Compare this vol., ii, 158).—The venoms of the Australian and Indian vipers contain substances which generate fibrin ferment from prothrombin, and coagulate any fibrinogen solution to which they are added. They may be assumed to consist of kinase and calcium salts. But as potassium oxalate increases their coagulating power, they probably consist of pure kinase, the necessary calcium being provided in adsorbed form by the fibrinogen. They cause intravascular clotting when rapidly injected, but if slowly injected, non-coagulable blood is obtained. The blood and tissues are able to deal with a slow formation of fibrin, and so general clotting does not ensue. Such blood owes its stability to absence of fibrinogen; as fibrinogen is regenerated, the blood re-acquires the power to clot. Cobra venom owes its anti-coagulating power to an anti-kinase, not to anti-thrombin. The failure of peptone blood to clot is attributed, not to anti-thrombin, but to excess of alkali secreted by the liver. Hirudin (leech extract) contains both anti-thrombin and anti-kinase.

W. D. H.

Blood Coagulation and Calcium Ions. Bertram J. Collingwood (*Proc. physiol. Soc.*, 1909, lxxix; *J. Physiol.*, 38).—The addition to freshly drawn blood of an equal volume of 2% solution of disodium hydrogen phosphate delays, but does not prevent, clotting. The salt, therefore, does not precipitate that portion of the calcium in the blood which is essential to coagulation. If, however, an alkaline solution of calcium chloride is prepared approximating to the calcium content and alkalinity of the blood, and an equal bulk of 2% disodium hydrogen phosphate added to it, all the calcium is precipitated. If the calcium in the blood was in simple solution, a similar precipitation should be expected there, but that, as just stated, is not the case. The conclusions drawn are that the blood carries calcium in some other way than in a state of simple solution, and that calcium ions are not essential to clotting. W. D. H.

The Influence of Cholesterol on Hæmolysis by Soaps. Wilhelm Meyerstein (*Arch. exp. Path. Pharm.*, 1909, 60, 385—389).—Cholesterol inhibits the rate of hæmolytic action of sodium oleate in simple mixtures; total inhibition is readily produced when the cholesterol and oleate solution are first heated together. The protecting action of cholesterol appears to be due to the fact that it is in solution; it does not act then directly on the blood-corpuscles, but links on to the soap and inhibits the hæmolytic action of the latter. Similar results were obtained with other substances, such as kephalin, cerebroside, and even other soaps, as with cholesterol. S. B. S.

Cobra Poison and Hæmolysis. II. Ivar Bang (*Biochem. Zeitsch*, 1909, 18, 441—498. Compare Abstr., 1908, ii, 721).—Cobra venom dissolves red corpuscles in a solution of sucrose without the addition of an activator. This is hindered by salts, and this inhibition is an action of the cation, directed not against the corpuscles, but against the poison. The inactivation by sodium chloride is reversible when the corpuscles are replaced in their own serum. All salts of strong acids and of acetic acid produce inactivation, whilst the salts of weak acids (carbonates, chromates, phosphates) do not. The reactivation by serum is attributed mainly to sodium carbonate. The poison itself is probably an acid, and the basic components of the corpuscles are believed to be the points to which the poison attaches itself; they act as the receptor. The blood is inactivated by remaining in sucrose solution, and the part played by the lipoid cell membrane in the passage of intracellular and extracellular saline materials is discussed. W. D. H.

The Biochemistry of Phasin. Otto Wienhaus (*Biochem. Zeitsch.*, 1908, 18, 228—260).—The seeds of various *Papilionaceae* yield extracts which agglutinate blood-corpuscles without exerting any other definite toxic action. The extracts from various plants have been examined, and especially those from white beans (*P. vulgaris*). The saline extract was precipitated with alcohol, and the precipitate contained the active substance. This was redissolved in water and reprecipitated with alcohol, and the precipitate was dried. The majority of experiments were carried out with an extract of this powder (phasin). It is but slightly toxic, although large doses on intravenous injection will kill small animals; cats and pigeons can tolerate doses of 1000 or 620 mg. No agglutination of blood takes place *in vivo*. The agglutin acts in very dilute solutions on blood-corpuscles of various species; also on the stroma and on formalised blood, and on suspensions of cells from different organs. The agglutin is not destroyed by prolonged heating; it retains its effect after heating for four days at 110—113°. It also resists digestion with proteolytic enzymes. The agglutin can be regenerated from its combination with stroma by means of dilute acids. S. B. S.

The Catalase from Blood. C. Gessard (*Compt. rend.*, 1909, 148, 1467—1468. Compare Cotton, Abstr., 1901, ii, 295).—A repetition of experiments already described. The author confirms the observations of Ville and Moitessier (Abstr., 1903, ii, 120) and of Senter (Abstr., 1903, ii, 661) relating to the existence of hæmase. Fibrin can be completely freed from this enzyme by centrifugalisation.

W. O. W.

Action of Digestive Enzymes on Each Other. William Bain (*Proc. Roy. Soc. Med.*, 1909, 2, *Therap. Pharmac. Section*, 165—172). —After two hours' digestion in pepsin-hydrochloric acid at 36°, the tryptic action of medicinal doses of various pancreatic digestive preparations is entirely destroyed; during one and a-half hours' digestion, the tryptic action is not completely destroyed. This suggests that doses of such preparations should be given after food at a time when the contents of the stomach are rapidly entering the intestine. The amylolytic action of pancreatic preparations is similarly destroyed in an hour, but the lipolytic enzyme retains about half its normal activity under the same treatment. Trypsin destroys the activity of pepsin and papain. W. D. H.

The Influence of Drugs on Gastric Secretion. Part IV. Inorganic and Organic Arsenic Compounds. JOHANN FEIGL and ADOLF ROLLETT (*Biochem. Zeitsch.*, 1909, 19, 156—180).—The technique was the same as that previously described for the investigation of iodine compounds (Abstr., 1908, ii, 311). Inorganic arsenious and arsenic salts and organic arsenic compounds, such as cacodylic acid and atoxyl, given by the mouth in very dilute solution, cause the secretion of one to three times the quantity of gastric juice produced by the same amount of pure water. G. B.

Relations of Secretin and Entero-kinase to Pancreatic Enzymes. JOHN MELLANBY and V. J. WOOLLEY (*Proc. physiol. Soc.*, 1909, xi—xii; *J. Physiol.*, 39).—Conversion of the rennet zymogen in pancreatic juice into rennet is rapidly accomplished by entero-kinase, and less rapidly by the addition of water. The conclusion is therefore drawn that the action of entero-kinase is hydrolytic. Antiseptic autolysis of the pancreas yields an extract containing all its enzymes; this is considered to be an indication that secretin does not combine with the zymogens to form active enzymes. W. D. H.

Metabolism during Typewriting. THORNE M. CARPENTER and FRANCIS G. BENEDICT (*J. Biol. Chem.*, 1909, 6, 271—288).—The results obtained with two men typing 1500 to 1600 words per hour show an increase of metabolism so that, per hour, 10—14 grams of carbon dioxide are produced, and 10—13 grams of oxygen are consumed, in excess of that which occurs during rest. Expressed in calories, the increase is about 25. Slow walking along a level road increases the metabolism by about 160 calories (Zuntz). W. D. H.

The Influence of Protein and Carbohydrate on Metabolism. A. GIGON (*Chem. Zentr.*, 1909, i, 1493; from *Skand. Arch. Physiol.*, 21, 351—367).—The experiments were carried out in a Sondén-Tigerstedt respiration apparatus. The protein selected was casein, the carbohydrate, dextrose. In the inanition period the excretion of carbon dioxide per hour was 23·8 grams. After the administration of sugar this rose to 29·9, and of casein to 28. If both foods were given, the figure rose to 34, the increase being the sum of those produced by the two foods separately. The excretion of nitrogen and phosphoric acid was not affected by the administration of sugar. W. D. H.

Purine Metabolism in Selachians. I. VITTORIO SCAFFIDI (*Biochem. Zeitsch.*, 1909, 18, 506—513).—The special point investigated was the uricolytic power of the liver of *Scyllium catulus*; it is very considerable, and is more rapid than in any other organ previously investigated. W. D. H.

Metabolism in Cystinuria. T. SHIRLEY HELE (*J. Physiol.*, 1909, 39, 52—72).—In the three cases examined, the cystine output was 0·3 to 0·5 gram per diem. Very slight alterations were produced by diet, but it was not possible to vary the diet so greatly as in Alsberg and Folin's case. Cystine given by the mouth to one patient was excreted almost entirely as sulphate. Cadaverine was only found once. Arginine given by the mouth to one patient was not excreted as putrescine. Diamino-acids were not found in the urine (one case); leucine and tyrosine were also absent, and glycine was not present in excess in the urine. W. D. H.

Oxidation in the Egg. II. Otto Warburg (*Zeitsch. physiol. Chem.*, 1909, 60, 443—452. Compare Abstr., 1908, ii, 963).—Further observations are recorded on the respiratory changes in the echinoderm egg, fertilised and unfertilised, and the increase in oxidation which occurs in hypertonic solutions. These results are discussed in relation to J. Loeb's hypothesis that the increase of oxidation which occurs in hypertonic sea-water is a factor in the production of artificial parthenogenesis. W. D. H.

Does Caviare Contain Purine Bases? Kurt Linnert (*Biochem. Zeitsch.*, 1909, 18, 209—210).—No purine bases were found when attempts to isolate them were made by the method of Burian and Walker Hall. S. B. S.

The New Formation of Amino-acids in the Animal Organism. Emil Abderhalden and Casimir Funk (*Zeitsch. physiol. Chem.*, 1909, 60, 418—425).—It is well known that glycine originates in the body, for the administration of benzoic acid leads to a greater excretion of hippuric acid than can be derived from the glycine preformed in the tissues; further, dogs fed on casein, which is free from this amino-acid, show no differences from dogs fed on proteins which contain it. On the other hand, the removal of tryptophan from the food, or the administration of proteins in which it is absent, has a serious effect. Henriques has shown that gliadin keeps rats in equilibrium, and so draws the conclusion that lysine originates in the body. The rat, however, is not a suitable experimental animal for this purpose; but it is shown that dogs thrive well on gliadin. The gliadin, however, contained 0·35% of lysine. If Henriques' gliadin also contained lysine, his conclusion needs revision.

W. D. H.

Mode of Oxidation in the Animal Organism of Phenyl Derivatives of Fatty Acids. IV. Fate of Phenylpropionic Acid and its Derivatives. V. Fate of Phenylvaleric Acid and its Derivatives. VI. Fats of Phenylalanine, Phenyl-β-alanine, Phenylserine, Phenylglyceric Acids, and Phenylacetaldehyde. Henry D. Dakin (*J. Biol. Chem.*, 1909, 6, 203—220, 221—234, 235—244).—IV. The results confirm those previously advanced as to the combustion of phenylpropionic acid in the body; part of the benzoylacetic acid formed is probably converted into benzoic acid without going through the stage of acetophenone. Under some conditions, cinnamoylglycine was isolated from the urine of animals that had received injections of sodium phenylpropionate. If phenyl-β-hydroxypropionic acid is given to dogs, benzoylacetic acid appears in the urine. Glycine derivatives of phenylpropionic acid, phenyl-β-hydroxypropionic acid, and cinnamic acids are far less readily attacked in the organism of dogs and cats than salts of the free acids.

V. Five acids of the type Ph·CCCCC·COOH, namely, phenylvaleric, β-hydroxyphenylvaleric, phenyl-Δ^{α}-pentenoic, phenyl-Δ^{β}-pentenoic, and cinnamylideneacetic acids, undergo oxidation in the body in such a way that four carbon atoms are removed from the side-chain in two pairs. In every case benzoic acid is the end product, the intermediate products being acetophenone, β-hydroxyvaleric acid, and probably cinnamoylglycine. This may be termed successive β-oxidation, and it appears to be a general biochemical reaction. Embden's results on the perfusion of the liver with salts of fatty acids are in harmony with this view. γ-Hydroxyphenylvaleric and cinnamylidenemalonic acids are scarcely attacked when administered to cats.

VI. The substances named are injected intravenously or subcutaneously in dogs and cats, and the urine examined. With phenylalanine, a large amount was recovered in the urine as such; α-carbamido-β-phenylpropionic acid was also present. In the case of phenyl-β-alanine, a small amount was recovered unchanged; β-hydroxyphenylpropionic acid, acetophenone, and hippuric acid were also obtained in the urine, but no cinnamoylglycine. After the administration of phenylserine, the only substance detected in the urine was hippuric acid. In dogs, two isomeric phenylglyceric acids led to the appearance of the unchanged acids in the urine, with a small quantity of hippuric acid. In cats no hippuric acid was found. After the subcutaneous injection of phenylacetaldehyde, a small amount of phenaceturic acid was found in the urine. W. D. H.

Theory of Catalase Action. Oscar Loew (*Pflüger's Archiv*, 1909, 128, 560—565).—There is no doubt that hydrogen peroxide is always formed when organic substances, labile hydrogen atoms, and molecular oxygen participate in oxidation; and it is believed that this acid occurs in living cells, and that catalase plays the part of energetically destroying the hydrogen peroxide. W. D. H.

Extracts of Selachian Organs. I. Extract of Acanthias Muscle. A. Suwa (*Pflüger's Archiv*, 1909, 128, 421—426).—Among the substances in extracts of the muscle of the fish *Acanthias vulgaris* are betaine, a substance but rarely found in animals, and trimethylamine oxide, $ON(CH_3)_3$, which has never been found previously either in animal or vegetable tissues. Creatine is present in small quantities, but creatinine is absent. W. D. H.

Distribution of Phosphoproteins in Tissues. II. R. H. Aders Plimmer and R. Kaya (*J. Physiol.*, 1909, 39, 45—51).—Phosphoprotein is present in dog's pancreas; its amount in the gland lessens on secretion, and it can be detected in the juice secreted. It is present in sheep's salivary glands and in frogs' eggs; as development progresses, it diminishes in amount just as in hens' eggs. It is absent from cod's testis. W. D. H.

The Occurrence of Lipases in Tissues. A. Pagenstecher (*Biochem. Zeitsch.*, 1909, 18, 285—301).—The investigations were carried out by determining the increase of acidity which resulted when olive oil, egg-yolk, and monobutyrin were treated with extracts of various organs for twenty-four hours in an incubator. The extracts were made by shaking for twenty-four hours the finely minced organs with saline solution and toluene, and expressing the juice. Muscular tissue and brain were found to have the smallest lipolytic action. Lungs and kidneys are more active, whereas the liver and spleen have the greatest activity. S. B. S.

The Internal Secretion of Chromaffine Tissue. R. H. Kahn (*Pflüger's Archiv*, 1909, 128, 519—554).—It is found, contrary to the statements of Schur and Wiesel, that neither in narcosis nor muscular work is there an increase or decrease of adrenaline in the blood, corresponding with a change in the adrenaline content, or the coloration of the chromaffine tissue. Waterman and Smit's statement that in puncture diabetes the blood contains a mydriatic substance was not confirmed. Mayer's statement that after extirpation of both suprarenal bodies, puncture diabetes cannot be induced was confirmed; the animals remained in a healthy state for some time after the double extirpation. The view that adrenaline is a hormone which stimulates muscular activity and causes the mobilisation of glycogen is therefore untenable. W. D. H.

Possibility of Maintaining Life of Animals after Complete Excision of the Thyroid Gland by the Use of Calcium or Magnesium Salts for their Nourishment. Albert Frouin (*Compt. rend.*, 1909, 148, 1622—1624).—The cachexia strumipriva incident on extirpation of the thyroid gland has been successfully combated by administering calcium or magnesium salts (chloride or lactate). Strontium chloride is without influence on the symptoms. Animals treated in this way increased in weight, and survived the operation several months; when the administration of the calcium salt was stopped, they continued to live without showing tetany or cachexia. These results appear to be due to elimination of carbamic acid by the calcium salt, since it is found that the urinary excretion of carbamates is increased, and that the ingestion of sodium carbamate produces tetany in thyroidectomised animals, whilst no objectionable symptoms follow if calcium chloride is administered simultaneously.

Salts of calcium have a similar action in tetanus, consequent on a pancreatic fistula or Eck's fistula (compare MacCallum, *J. Expt. Med.*, 1909, 11, 18). W. O. W.

Peritoneal Exudation in a Carp. Franz Zaribnicky (*Zeitsch. physiol. Chem.*, 1909, 60, 408—410).—As in cold-blooded animals the total amount of blood is only 1/63 of the body-weight, information regarding its composition is scanty. In the present experiment, however, the blood of the carp was not investigated, but a peritoneal exudation, of which 500 c.c. were obtained. After removal of the fibrin it had D 1·015; it was alkaline to litmus, and contained 1·68% of coagulable protein, 0·077% of fat, 0·2% of total nitrogen, and 0·6% of ash. Urea, uric acid, allantoin, purine bases, and sugar were absent. By fractional salting out, the protein present was separated into globulin and albumin. W. D. H.

Distribution of Nitrogen in the Precipitation by Acids and by Rennet of Cow's, Buffalo's, Goat's, Human, and Ass's Milk. Willi Friedheim (*Biochem. Zeitsch.*, 1909, 19, 132—155).—It was known before that in the curdling of cow's milk by rennet more nitrogenous substances remain in solution in the whey than when the curdling is brought about by acids. It is now shown that the same difference exists in the case of the other kinds of milk mentioned. The difference amounts to about 10% of the total nitrogen, except in the case of ass's milk, where it is about 5·5% of the total. G. B.

The Acidity of Urine. Wilhelm E. Ringer (*Zeitsch. physiol. Chem.*, 1909, 60, 341—463).—A 0·208% solution of phosphoric acid was taken, and the concentration of hydrogen ions determined with hydrogen electrodes. Sodium hydroxide was then added so that the percentage of phosphoric acid remained constant. From a number of measurements, a curve was constructed which showed the "acidity" of the sodium dihydrogen phosphate and the disodium hydrogen phosphate in various concentrations. Urines were then taken and the hydrogen ions estimated in the same way, and in some cases titration with phenolphthalein was performed, and a comparison with the curve first referred to enabled the proportion of the two phosphates to be determined; it was found that the greatest amount of the phosphoric acid is present as H_2PO_4 ions. The long-continued passage of hydrogen through the urine somewhat lessened its acidity; this is perhaps due to carbon dioxide; nevertheless, air free from carbon dioxide causes a slight rise of acidity. After the deposition of urates, the acidity (taken the next day) falls a little. W. D. H.

The Output of Organic Phosphorus in Urine. G. C. Mathison (*Bio-Chem. J.*, 1909, 4, 233—239).—The amount of organic phosphoric acid varies considerably, but is usually more than 0·1 gram per diem, or about 6% of the total. Glycero-phosphoric acid is not broken down in digestion experiments *in vitro*. When added to the diet, it increases the total output of phosphates, but not of organic phosphorus. Vigorous exercise does not influence the latter. W. D. H.

Effects of Chocolate and Coffee on Uric Acid and the Purines. Pierre Fauvel (*Compt. rend.*, 1909, 148, 1541—1544. Compare Abstr., 1906, ii, 564).—In the case of persons on a vegetarian diet, chocolate and coffee increase the excretion of purine bases, but diminish the uric acid excretion. . This diminution does not appear to be due to retention by the organism, since sodium salicylate produces under these conditions only a slight increase, and this is followed on the next day by a corresponding diminution of the excretion. During the prolonged use of chocolate and coffee on a diet otherwise free from purine bases, the excretion of uric acid rapidly becomes constant and remains at the minimum of endogenous origin. W. O. W.

Excretion of Quinine in Urine. M. Nishi (*Arch. exp. Path. Pharm.*, 1909, 60, 312—323).—See this vol., ii, 710.

Peptolytic Enzymes in Cancer. Emil Abderhalden and Peter Rona (*Zeitsch. physiol. Chem.*, 1909, 60, 415—417).—When blood-free carcinoma tissue is subjected to pressure, the juice obtained is capable of splitting glycyl-*l*-tyrosine. This is true for all cancers of the adeno-carcinoma type, and also for normal tissues. When the growth consists mainly of connective tissue stroma (Scirrhus), this does not occur. This accords with the observations of Hess and Saxl. Twelve tumours in all were investigated, an admittedly small number.

W. D. H.

Blood Changes in Cyanosis due to Congenital Heart Disease. H. S. French, Marcus S. Pembrey, and John H. Ryffel (*Proc. physiol. Soc.*, 1909, ix—x; *J. Physiol*, 39).—In this condition there is chronic deficiency of oxygen, and this is compensated for by an increase in the number of red-corpuscles. A few estimations of lactic acid in the urine are appended in comparison with estimations in health and other diseases, but the figures given are obviously too scanty for correct deductions to be drawn. W. D. H.

Diabetic Lævulosuria and the Detection of Lævulose in Urine. L. Borchardt (*Zeitsch. physiol. Chem.*, 1909, 60, 411—414. Compare Abstr., 1908, ii, 578).—Polemical. It is held that dextrose is the only sugar in diabetic urine, and that no grounds exist for the statements that lævulose ever occurs in the urine. W. D. H.

The Physiological Action of Colloidal Metals. Carlo Foà and Alberto Aggazzotti (*Biochem. Zeitsch.*, 1909, 19, 1—82).—The intravenous injection of colloidal silver (collargol) is fatal to dogs in a dose of 2·5 mg. per kilo. of body-weight. The body temperature may be raised 2—2·5°. Large doses produce phosphaturia and nephritis. The effects of electrically prepared silver are similar, but dogs show marked tolerance to sub-fatal doses, so that ultimately more than double the dose may be given which ordinarily would be fatal.

For colloidal arsenious sulphide the fatal dose in dogs is 9 mg. per kilo.; it does not raise the body temperature, and there is no tolerance.

Of the other colloids examined, platinum and ferric hydroxide are relatively inert; mercury resembles silver in that it raises the body temperature.

The protective effect of an injection of some colloids, for example, collargol, following an injection of a bacterial toxin is probably due to the enhanced power of the organism to oxidise toxins, and not to any direct action on the toxins themselves. G. B.

Action of Methyl and Ethyl Alcohol on Muscle. Fritz Verzár (*Pflüger's Archiv*, 1909, 128, 398—420).—In frog's muscle both methyl and ethyl alcohols first increase and then decrease the excitability. Methyl alcohol has about one half the toxicity of ethyl alcohol. W. D. H.

Physiological Action of Pressor Amines. Henry H. Dale and Walter E. Dixon (*J. Physiol.*, 1909, 39, 25—44).—In an

investigation dealing with most of the functions of the body, it was found that *iso*amylamine and *p*-hydroxyphenylethylamine have an action like that of adrenaline, both reproducing the inhibitory and specially the motor effects of sympathetic nerves. *iso*Amylamine is the weaker of the two, and both are less powerful than adrenaline. Both are absorbed from the subcutaneous tissues and from the alimentary canal, and produce their effects when so administered.
W. D. H.

The Active Principles of Ergot. George Barger and Henry H. Dale (*Proc. physiol. Soc.*, 1909, lxvii–lxxix; *J. Physiol*, 38).—The rise of blood-pressure produced by aqueous extracts of ergot cannot be wholly attributed to ergotoxine, and after this substance is removed, their pressor action remains considerable. Further investigation showed that the extracts contain the two substances recently separated from putrid animal tissues; of these, *p*-hydroxyphenylethylamine (Barger, Trans., 1909, 95, 1123) is far more abundant than *iso*amylamine. The action of this substance on the uterus, like that on the vascular system, simulates the action of sympathetic nerves. Whether these bases are produced by the enzymes of the fungus itself, or in any degree by bacteria during the process of extraction, is unsettled, but in either case the notorious variability of the official liquid is readily intelligible. W. D. H.

A Reversed Action during Anæsthesia. The Action of Certain Convulsants. Charles R. Marshall (*Proc. physiol. Soc.*, 1909, lxxxii; lxxxiii—lxxxiv; *J. Physiol.*, 38).—An effective dose of tutin or coriamyrtin increases the frequency of respiration in normal animals, but diminishes it in those anæsthetised with chloroform. The reversion is not so marked if ether is used as the anæsthetic. It is probably due to the depressant influence of anæsthetics on the medullary centres, and attention is drawn to previously described instances of similar reversed or modified actions.

Both tutin and coriamyrtin act on the brain in the same manner as absinthin and picrotoxin; coriamyrtin is the more toxic of the two; their predominant effect is epileptiform convulsions. The action is mainly on the cerebrum and to a less degree on the pontine nuclei. The spinal cord and bulb are not affected. W. D. H.

Action of Substances which Temporarily Abolish the Respiration. Charles R. Marshall (*Proc. physiol. Soc.*, 1909, lxxxiv—lxxxv; *J. Physiol.*, 38).—One of certain tropeines investigated, namely, protocatechyltropeine, was found temporarily to paralyse the respiration when intravenously (but not subcutaneously) administered in animals. Tappeiner has described a similar action in various methochlorides and other quaternary compounds. Protocatechyltropeine is a tertiary base. Evidence is adduced that the action is a central, not a peripheral, one, neither is it due to the circulatory disturbances which are produced. W. D. H.

Myosis and Reduction of Blood Pressure Caused by Normal Human Urine. J. E. Abelous and E. Bardier (*Compt. rend.*, 1909, 148, 1471—1472).—The material precipitated from urine by alcohol is submitted to dialysis, and the colloidal fraction, which shows the reactions of a proteose, precipitated by ammonium sulphate. The precipitate is dissolved in water, dialysed, and the colourless solution treated with alcohol. The grey powder thus obtained is soluble in water, and when injected into a vein produces intense myosis, accompanied by considerable lowering of the blood pressure. The name "urohypotensin" is suggested for this substance.

W. O. W.

Carbon Monoxide Poisoning by Explosion Gases. Louis Lewin and Otto Poppenberg (*Arch. exp. Path. Pharm.*, 1909, 60, 434—460).—Analyses were made of the gases obtained by explosion of a number of different explosives. The physiological action of these gases on animals was investigated, the conditions of the experiments being so chosen as to imitate as nearly as possible the conditions in practice. It was shown that carbon monoxide alone was in most cases sufficient to account for the symptoms. Explosives containing the nitro-group, such as dynamite, etc., yield on explosion nitric oxide. The amounts obtained by explosion were estimated, and it was shown that this gas could also account for toxic symptoms.

S. B. S.

The Poisonous Action of the Cyanogen Compounds Employed as Artificial Manures. Walter Stritt (*Zeitsch. Hyg. Infekt. Krank.*, 1909, 62, 169—198).—Comparative experiments have been made on frogs, rabbits, and dogs with cyanamide, dicyanodiamide, and calcium cyanamide. The results showed that all these substances are poisonous, cyanamide having the highest toxicity, and calcium cyanamide the least. Probably about 10 grams of calcium cyanamide would constitute a lethal dose of this substance for an adult, but this amount could hardly be administered by accident or design without the knowledge of the individual. F. M. G. M.

Chemistry of Vegetable Physiology and Agriculture.

The Nuclein Ferments of Yeast. M. N. Straughn and Walter Jones (*J. Biol. Chem* , 1909, 6, 245—255).—Yeast contains guanase, but adenase and xantho-oxydase are absent. W. D. H.

The Fermentation of Amino-acids. Jean Effront (*Mon. Sci.*, 1909, [iv], 23, i, 145).—In the fermentation of glycine, asparagine, and glutamic acid by brewers yeast, all the nitrogen is transformed into ammonia. The fermentation of betaine gives rise to trimethylamine. These bases remain combined with volatile organic acids. The amount of these acids produced during fermentation is always in excess of the calculated amount, inasmuch as a certain quantity is derived from the protoplasm of the yeast. The composition of these acids varies with the nature of the amino-acid undergoing fermentation; acetic acid is the principal product from glycine and betaine, asparagine furnishes chiefly propionic acid, whilst butyric acid in considerable amount arises from the fermentation of glutamic acid. In all these instances, however, the three acids are produced to a certain extent, and the paper contains tables showing these proportions.

F. M. G. M.

Biochemical Change of Asparagine and Aspartic Acid into Propionic and Succinic Acids. Carl Neuberg and Cesare Cappezzuoli (*Biochem. Zeitsch.*, 1909, 18, 424—430).—By the action of a putrefactive mixture on aspartic acid, formic, propionic, and succinic acids were formed. Corresponding amounts of ammonia and unchanged aspartic acid were recovered. Asparagine yielded the same products, but larger amounts of propionic and succinic acids were obtained.

S. B. S.

The Behaviour of Racemic Glutamic Acid in Putrefaction. Carl Neuberg (*Biochem. Zeitsch.*, 1908, 18, 431—434).—The racemic glutamic acids behave on putrefaction in the same way as the natural dextrorotatory acid, yielding formic, butyric, and succinic acids. The formation of an optically active form could not be ascertained.

S. B. S.

The Behaviour of *d-l*-Aminovaleric Acid (*d-l*-Valine) in Putrefaction. Carl Neuberg and Lázló Karczag (*Biochem. Zeitsch.*, 1908, 18, 435—439).—*d-l*-Aminovaleric acid on putrefaction undergoes deaminisation, yielding a valeric acid, presumably *iso*valeric acid. A small part of the amino-acid is converted into butylamine. The residual aminovaleric acid was lævorotatory in hydrochloric acid, indicating an asymmetric attack by the bacteria. S. B. S.

Decomposition of Uric Acid by Bacteria. F. Liebert (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 54—64).—It has previously been shown that carbamide and carbon dioxide are products of the bacterial decomposition of uric acid. Gérard (Abstr., 1896, ii, 668) assumed that alloxan was an intermediate product, and Ulpiani (Abstr., 1904, ii, 138; Ulpiani and Cingolani, 1905, ii, 190) that tartronic acid was produced. Neither of these substances was isolated, and these assumptions are probably erroneous. When the ærobic bacteria *Bacillus pyocyaneus*, *B. fluorescens liquefaciens*, *B. fluorescens non liquefaciens*, and *Bacterium calco-acetum* are employed, it is shown that uric acid is oxidised to allantoin and carbon dioxide, the allantoin then being further oxidised to carbamide and oxalic acid. It is further shown that during these changes there is a successive production of two distinct floras of bacteria, the above-named characteristic of the neutral or feebly acid medium, and the others which are developed in the alkaline liquid, namely, *B. odoratum* and *B. musculi*.

B. pyocyaneus and *B. Stutzeri*, in the presence of uric acid and potassium nitrate, cause denitrification of the latter.

Under anærobic conditions at 35°, and in the presence of magnesium phosphate to combine with ammonia, the organism *B. acidi urici*, a spore-forming, mobile microbe, decomposes uric acid, with the formation of 3 mols. of carbon dioxide, ammonia, and acetic acid. W. R.

The Bacterial Degradation of the Primary Scission Products of Proteins. Walter Brasch (*Biochem. Zeitsch.*, 1909, 18, 380—390).—The degradation of glutamic acid to butyric acid by various bacteria isolated from putrefaction mixtures was investigated. It was found that the ærobic bacteria play but a small part in this chemical action, which appears to be brought about chiefly by *Bacillus putrificus* (Bienstock). Butyric acid resists further degradation by this organism.

S. B. S.

Assimilation of Nitrogen of the Air by Soil Micro-organisms. Fr. Straňák (*Zeits. Zuckerind. Böhm*, 1909, 33, 599—614).—Whilst *Azotobacter* is very widely distributed, being found in arable, meadow, and forest soils of various kinds, and even in sea-water, it is found to be absent in many virgin soils, especially peat land, in Bohemia, and also in soils situated at considerable elevations. It occurs, however, in virgin soils, bearing a luxuriant vegetation of blue and green algæ.

Experiments in which pure cultivations of *Azotobacter* were supplied with various carbohydrates showed that the following amounts of nitrogen (in mg. per litre) were assimilated: arabinose, 180·2; lævulose, 155·4; dextrose, 152·3; xylose, 143·0; galactose, 141·5; sucrose, 125·1; maltose, 86·0; lactose, 81·6, and rhamnose, 49·8. Pure cultivations of *Azotobacter* with mannitol assimilated 74·9—124·6 mg. N per litre, whilst impure cultivations assimilated 155—206 mg.

In presence of nitrates, *Azotobacter* cannot assimilate free nitrogen. When solutions containing much nitrate are inoculated with *Azotobacter* and *Radiobacter*, the latter denitrifies the nitrate, and the free nitrogen thus produced is then assimilated by the *Azotobacter*.

Inoculation experiments with *Azotobacter* applied directly to the plots gave increased yields of mangolds, oats, and potatoes. Still better results were obtained when, instead of direct inoculation, the cultures were first added to small quantities of soil (5 kilos.) containing dextrose (250 grams), and kept for three months at 24° before being employed as inoculating material. N. H. J. M.

Assimilation of Nitrogen as Ammonia, Nitrates, and Amides by Micro-organisms. Steven Bierema (*Centr. Bakt. Par.*, 1909, ii, 23, 672—726).—Sodium nitrate is readily assimilated by soil organisms in presence of sucrose, glycerol, and calcium lactate, but less readily with lævulose, starch, maltose, and calcium succinate as sources of carbon. Ammonium nitrate is less readily assimilated, whilst magnesium ammonium phosphate proved to be one of the best sources of nitrogen, notwithstanding its very slight solubility. Formamide and acetamide are not very readily assimilated; the latter serves, however, as source of both nitrogen and carbon. Guanidine carbonate alone has very little effect; better results were, however, obtained in presence of calcium lactate, and sucrose + glycerol. Uric acid is completely converted into ammonium carbonate, but less readily than urea. Leucine and tyrosine, especially the former, are readily assimilated. Ammonium formate is only slightly assimilated; ammonium acetate gives better results, especially in presence of dextrose, whilst ammonium butyrate is still more readily utilised.

A number of quantitative experiments with various ammonium salts and organic nitrogenous compounds are described.

N. H. J. M.

Mechanism of Denitrification among Indirect Denitrifying Bacteria. Léon Grimbert and Bagros (*J. Pharm. Chim.*, 1909, [vi], **30**, 5—10).—Further evidence is brought forward in favour of the view already expressed (Abstr., 1900, ii, 97) that the liberation of a mixture of nitrogen and carbon dioxide by *Bacillus Coli* and *B. d'Eberth*, from media containing meat extract, peptone, and nitrates, is due to reduction of the nitrate to nitrite and interaction of the latter with amino-compounds in presence of acids generated by the fermentive action of the bacillus. In proof of this it is shown that nitrated peptone containing either of these bacilli gives off no gas until both a carbohydrate capable of being fermented to acid, and an amino-compound have been added. T. A. H.

Hydrolysis of the Phosphorescent Infusoria of the North Sea (Noctiluca milaris). Oskar Emmerling (*Biochem. Zeitsch.*, 1909, **18**, 372—374).—The following amounts of hydrolysis products were obtained from 100 grams: Lysine, 0·212 gram; arginine, 1·65 grams; histidine, 3·47 grams; tyrosine, 0·52 gram; glycine, 5·90 grams; alanine, 2·4 grams; leucine, 0·42 gram; proline, 4·60 grams; aspartic acid, 0·17 gram. S. B. S.

Influence of Certain Nutrient Media on the Development of Embryos of Pinus Pinea. Jules Lefèvre (*Compt. rend.*, 1909, **148**, 1533—1536. Compare this vol., ii, 33).—The author confirms Lubimenko's conclusion (Abstr., 1906, ii, 624) that sucrose is essential to the development of the isolated embryo. He finds also that whilst peptones and asparagine act as nutrients in the presence of sucrose, yet when added alone they are without effect, and in large doses they inhibit the growth of the embryo. Other amides hinder development when added to the extent of 0·5%. W. O. W.

Elaboration of Nitrogenous Matter in the Leaves of Living Plants. Gustave André (*Compt. rend.*, 1909, **148**, 1685—1687).—The author has determined the amount of total nitrogen, amidic nitrogen, and nitrates present in chestnut leaves at different periods of growth, and from the results has arrived at the conclusion that the rate of production of nitrogenous material is constant, but that during the period of fertilisation the rate at which amidic nitrogen is transferred from the leaves to other organs is considerably increased.

W. O. W.

Fermentative Cleavage of Ammonia in Higher Plants. Alexander Kiesel (*Zeitsch. physiol. Chem.*, 1909, 60, 453—459).—Etiolated seedling of *Vicia Faba* (twenty-three to twenty-four days) were passed through a mincing machine and the sap expressed. The total nitrogen, and the nitrogen as proteins, as bases and peptone, as ammonia, and as amides were determined in the original sap and in sap which has been treated with chloroform and toluene and kept for twenty-five days at 37°. The results showed that a considerable amount of ammonia, representing 11·21% of the total nitrogen, was produced. The losses of protein nitrogen and amide nitrogen were only 2·30 and 3·42% respectively, so that much of the ammonia must have been derived from other undetermined forms of nitrogen (chiefly amino-acids).

The negative results obtained by Butkewitsch may have been due to the destruction of the ferment in the process of drying, or to the employment of younger seedlings, in which the primary processes may conceal more or less the secondary ones. N. H. J. M.

Autolytic Decomposition of Arginine in Plants. Alexander Kiesel (*Zeitsch. physiol. Chem.*, 1909, 60, 460—461).—The expressed sap of seedlings (two weeks' old) of *Lupinus luteus* was treated with chloroform and toluene and kept for about four weeks at 37°. It was found that the arginine, of which the original sap contained a considerable amount, completely disappeared. The sap gave with copper carbonate a green solution, from which a yellow, crystalline precipitate (indicating the presence of guanidine) was obtained by successive treatment with hydrogen sulphate and sodium picrate. The amount of nuclein bases was increased by autolysis.

N. H. J. M.

Behaviour of Asparagine in the Autolysis of Plants. Alexander Kiesel (*Zeitsch. physiol. Chem.*, 1909, 60, 476—481).—An experiment with seedlings of *Lupinus albus* showed that asparagine disappears during autolysis. An attempt was made to obtain the ferment which decomposes asparagine by precipitation with alcohol, but without result. N. H. J. M.

The Moving Out of Calcium and Magnesium Ions from the Plant Cell. Bronislaw Niklewski (*Ber. Deut. bot. Ges.*, 1909, 27, 224—227).—It was found by Hansteen that wheat grown in water cultures and supplied with calcium salts only made normal root growth, but not when the cultures contained either potassium, sodium, or magnesium salts alone; in all these cases, toxic symptoms showed themselves. Addition of a calcium salt, even in small quantities, completely restored the plant; thus no poisoning appeared with a ratio $K_2O/CaO = 840$. The optimum root development took place when $K_2O/CaO = 0\cdot84$.

The author offers an explanation of these facts, based on the following observations. Equal-sized pieces of beet were placed in each of the following solutions: (1) distilled water; (2) *N*/20-potassium chloride; (3) *N*/20-sodium chloride; (4) *N*/20-ammonium chloride. The amounts of lime and magnesia diffusing out from the cell in the four cases were (1) 5·3 and 4·1; (2) 33·4 and 23·8; (3) 32·1 and 20·8; (4) 29·2 and 21·3 mg. per 500 c.c. of the solution, and were thus considerably increased when salts were present in the circumambient solution. The author therefore supposes that in Hansteen's experiment there has been a moving out of calcium and magnesium ions from the cell into the culture solution, the injurious effect of which is only counteracted when the calcium ions in the solution reach a certain concentration. E. J. R.

Various Relations between Calcium and Magnesium in Nutritive Solutions. J. W. Konowaloff (*J. exper. Landw.*, 1909, 10, 317—320).—Sand-culture experiments with wheat, without calcium and with varying relations of CaO : MgO from 0·2 : 1 to 26·6 : 1, showed that the total yield increased with the amount of lime until the ratio CaO/MgO = 6·7/1, after which there was a fall. The yield of grain was highest when the ratio was 13·3/1. Similar results were obtained with white lupins and *Setaria italica.*

Water-culture experiments with oats showed that the total produce, including roots, was highest when the ratio CaO/MgO was 6·7/1 and 13·3/1 (both equal); with a greater amount of calcium the yield fell considerably. In a second experiment the highest yield was with the ratio CaO/MgO = 6·7/1. N. H. J. M.

Carbon Dioxide Assimilation and Nutrition of Plants with Formaldehyde. Thomas Bokorny (*Pflüger's Archiv,* 1909, 128, 565—586. Compare Abstr., 1892, 1259; this vol., ii, 70).—Experiments with cress grown under a bell-jar, over a 30% solution of sodium hydroxide containing small amounts of formaldehyde, showed that formaldehyde vapour is absorbed by the upper portions of the plants and assimilated. N. H. J. M.

The Nature of the Cutin contained in "Crude Fibre." W. Sutthoff (*Zeitsch. Nahr. Genussm.*, 1909, 17, 662—663).—The cutin separated from the "crude fibre" of various grasses, brans, and straws by the method described by König, Fürstenberg, and Murdfield (Abstr., 1906, ii, 793) is a wax-like substance, which contains a considerable quantity (from 15 to 34%) of silica. The dry, ash-free substance contains from 64·72 to 69·97% of carbon, and from 9·65 to 12·40% of hydrogen. When the substance is saponified, an alcohol, m. p. 55—56°, is liberated, the molecule of which contains 17 atoms of carbon, whilst the acid portion of the substance consists apparently of a mixture of fatty acids, m. p. about 30°. W. P. S.

Sucro-clastic Enzymes in Beta vulgaris. R. A. Robertson, James Colquhoun Irvine, and Mildred E. Dobson (*Bio-Chem. J.*, 1909, 4, 258—273).—The polarimetric method was employed in the investigation. Diastase occurs in all parts, in the leaf associated with invertase and maltase, in the stem with emulsin in addition, whilst in the root it is accompanied by maltase, inulase, and emulsin, invertase being absent. It is suggested that in the mixture of enzymes they may mutually affect each other's actions. Other complicating factors are the influence of light and darkness (as in leaf and root), differences of osmotic pressure in various cells, differences in reaction of cell contents, and the presence of hydrolytic products. The apparently unlimited quantity of disaccharides capable of being formed in the living plant is in marked contrast to the small results obtained *in vitro*. The reactions concerned in carbohydrate metabolism in the plant are probably reversible, but the actual experimental results recorded on reversible zymolysis do not appear very conclusive. W. D. H.

Investigations of the Beans of Phaseolus vulgaris at Different Stages of Development. URS PFENNINGER (*Ber. Deut. bot. Ges.*, 1909, 27, 227—234).—The translocation of various nitrogen compounds from the pod to the seed is definitely established by the author, whose experiments show that the decrease of nitrogenous substance in the pod goes *pari passu* with the increase in the seed. The pods were found to contain protein, asparagine, allantoin, tyrosine, alloxuric bases, arginine, choline, and trigonelline, probably also lysine and leucine. In the early stages of development, 1·41% of nitrogen was present in the pod as protein, and 1·65% as non-protein, making a total of 3·06%; in the final stages the total nitrogen was 0·88% (due to the great increase in the non-nitrogenous compounds), of which 0·87% was protein. The seeds contained protein, tyrosine, alloxuric bases, arginine, choline, and trigonelline; the total nitrogen was at first 5·00%, 3·59% being protein and 1·41% non-protein; in the final stage the total nitrogen was 4·23%, 4·01% being protein.

Reduced to weights in grams, the results are as follows:

	100 pods contain			100 beans contain		
	Total N.	Protein N.	Non-protein N.	Total N.	Protein N.	Non-protein N.
1st Stage ...	1·56	0·72	0·85	0·0284	0·0204	0·0080
2nd Stage...	1·89	1·23	0·66	0·3325	0·2858	0·0467
3rd Stage ...	0·58	0·57	0·01	1·903	1·804	0·0989

It is noteworthy that the seed when ripe contains more non-protein nitrogen than in its earlier stages. E. J. R.

The Fruit of Pyrus arbutifolia. BURLEIGH B. REED (*Chem. News*, 1909, 99, 302).—The ripe berries were gathered in the vicinity of Sylvan Beach, New York, and they were dried and submitted to prolonged extraction with boiling alcohol and with boiling water. The extract was acid in reaction, and contained sugar, chiefly lævulose, to the extent of 68·27% of the berries. After drying and grinding the extracted fruit, it was successively digested with portions of ether for a long while; a small quantity (1·34% of the original fruit) of a yellow oil was obtained; $D^{15·5}$ 0·80. The berries contained 4·4% of ash, which gave on analysis the following percentage composition:

SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	Mn.	Cr.	SO_3.	P_2O_5.
trace	2·54	6·71	16·2	5·67	38·94	24·11	0·027	0·001	2·90	2·87

Besides this the fruit was found to contain tartaric acid, citric acid, and 0·84% of nitrogen. J. V. E.

Relation between the Utilisation of Reserve Carbohydrates and the Flowering of Ranunculus velutinus. C. Ferrari (*Bied. Zentr.*, 1909, **38**, 426; from *Staz. sper. agrar. ital.*, 1908, **41**, 127).—Removal of the buds merely prolonged the vegetative period, without the marked development of the vegetative system observed by Mattirolo in the case of *Vicia Faba*. The plants retained their green colour, and the irregular spots on the upper sides of the leaves, which generally disappear during the flowering period, remained. The amount of insoluble starch was doubled. N. H. J. M.

Determination of Temperature of Pasteurisation of Milk in Connexion with its Industrial Application. Influence of Heat on Conservation of Physiological Properties of Milk. Pierre Mazé, P. Guérault, and Dinescu (*Compt. rend.*, 1909, **148**, 1469—1471).—Unless carried out under suitable conditions, pasteurisation of the milk diminishes the yield of cheese, owing to changes brought about in the casein, whereby a considerable proportion escapes coagulation. The maximum yield is obtained when pasteurisation is carried out at 67—68°. W. O. W.

Manuring Sugar Beet with Sodium Chloride. Heinrich Mette (*Zeits. Zuckerind. Böhm.*, 1909, **33**, 620—621).—The results of plot experiments with sugar beet showed that an application of sodium chloride (100 kilos. per $\frac{1}{4}$ hectare) increased the yield of roots and the percentage of sugar, and the conclusion is drawn that, whilst sodium chloride is without appreciable effect in the case of good soils with a normal rainfall, it is very efficacious on light soils in a hot climate with a deficient rainfall. N. H. J. M.

Action of Manganese Sulphate on Various Crops. M. de Molinari and O. Ligot (*Bied. Zentr.*, 1909, **38**, 427; from *Ann. Gembloux*, 1908, 609).—Manganese, copper, zinc, and ferrous sulphates failed to increase the yields of oats and barley. The soil contained, however, a good deal of manganese. N. H. J. M.

Action of Sodium Nitrate, Ammonium Salts, Calcium Cyanamide, and Norwegian Calcium Nitrate. Wilhelm Schneidewind, Diedrich Meyer, H. Frese, F. Münter, and J. Graff (*Bied. Zentr.*, 1909, **38**, 366—379; from *Arb. deut. landw. Ges.*, 1908, No. 146).—The results of pot experiments in which rye and barley were given with various nitrogenous manures showed that increase of grain was as follows (sodium nitrate = 100): ammonium sulphate, 84; calcium cyanamide, 80—82; fish meal, 73; meat meal, 71; blood meal, 56; horn meal, 55, and leather meal, 15.

Field experiments are described in which the relative values of sodium and calcium nitrates, ammonium salts, and calcium cyanamide, applied to cereals, potatoes and sugar beet, are compared.

N. H. J. M

Influence of Soil Moisture on the Action of Calcium Cyanamide. Sante de Grazia (*Bied. Zentr.*, 1909, **38**, 421; from *Staz. sper. agrar. ital.*, 1908, **41**, 115).—The utilisation of calcium cyanamide is greatest when the soil is moist for some time after it has been applied. In the case of dicyanodiamide, moisture has hardly any effect. N. H. J. M.

Manurial Experiments with Calcium Cyanamide on Winter Cereals and Sugar Beet. ADOLF RITTER VON LIEBENBERG (*Bied. Zentr.*, 1909, 38, 379—385; from *Zeitsch. landw. Versuchs. Oesterr.*, 1908, 11, 153—180).—In an experiment with summer wheat it was found that only 25—38% of the nitrogen of calcium cyanamide was taken up, and not more than 50% in the case of sodium nitrate and ammonium sulphate. The manures showed no after effect when winter rye was grown on the same plots; the amount of nitrogen was even less than on the unmanured plot. N. H. J. M.

Effect of Increasing Amounts of Phosphatic Manures on the Amounts of Organic Phosphorus and Nitrogen Compounds, and on the Relation between Phosphorus and Nitrogen in Maize Grain. A. PARROZZANI (*Chem. Zentr.*, 1909, i, 1036; from *Staz. sper. agrar. ital.*, 41, 729—738).—Applications of increasing amounts of phosphorus in the form of mineral phosphates increased the percentages of total phosphorus and of phosphorus as lecithin in the grain of maize, whilst the phosphorus as nuclein remained the same. No effect was produced on the amount of total nitrogen; there was, however, a slight gain in protein nitrogen, due to a considerably increased production of zein under the influence of phosphatic manure, whilst the amounts of other proteins were diminished.

The results indicate that phosphatic manures have a marked effect on the activity of chlorophyll assimilation, and that in absence of corresponding amounts of nitrogen the phosphorus tends to accumulate in the grain. N. H. J. M.

Analytical Chemistry.

Analysis of Coal-Gas and Similar Gaseous Mixtures; Estimation of Nitrogen in Coal-Gas. GEORG VON KNORRE (*Chem. Zeit.*, 1909, 33, 717—719).—The first part of the paper consists in a criticism of the methods usually employed in analysing coal-gas.

Jäger's process (partial combustion with copper oxide) may be improved by first expelling the air from the small combustion tube by means of nitrogen, which may be readily made for the purpose by introducing air into the phosphorus pipette. The combustion tube is best made of fused silica. If nitrogen only is to be estimated, 100 c.c. of the coal-gas are at once passed slowly over the red-hot copper oxide. L. DE K.

Reduction of Perchlorates by Titanium Sesquisulphate. Arthur Stähler (*Chem. Zeit.*, 1909, 33, 759).—A criticism of Rothmund's process (this vol., ii, 434). The author has used titanium sesquisulphate for the reduction of perchlorates previously (*Ber.*, 1903, 36, 166, 1549), but the results (titration of the excess of the sesquisulphate with iron solution) were not very satisfactory. Good results, however, may be obtained by estimating the chloride formed in the reaction as proposed by Rothmund. For small quantities of chlorine, Richard's nephelometer (Abstr., 1904, ii, 287) is recommended.

L. de K.

Estimation of Iodine in Protein Combinations. Louis W. Riggs (*J. Amer. Chem. Soc.*, 1909, 31, 710—717).—In the estimation of the iodine in protein combinations by Baumann's method (Abstr., 1896, ii, 487), a portion of the halogen is oxidised to iodate during the fusion. After the estimation of the iodine, present as iodide, by the usual method, it is necessary, particularly in the case of proteins of small iodine content, to reduce the iodate by Devarda's alloy and sodium hydroxide, and to estimate the iodine in the iodide thus formed. Mixtures of protein substances and potassium iodide, analysed by the foregoing process, do not give results comparable with those obtained by the analysis of a protein substance containing combined iodine.

Excess of nitrous acid reduces iodates in such a way that the iodine cannot be estimated colorimetrically in carbon tetrachloride. C. S.

Estimation of Sulphur in Coals and Cokes. M. Holliger (*Zeitsch. angew. Chem.*, 1909, 22, 1361—1362).—A reply to Dennstedt (compare this vol., ii, 343, 435). The author thinks Dennstedt's process a good one, but advises the use of a small Peligot tube filled with hypobromite solution as a trap. The contents are afterwards tested for sulphuric acid. L. de K.

Estimation of Total Nitrogen by E. A. Mitscherlich's Method. Vincent Schenke (*Chem. Zeit.*, 1909, 33, 712—713).—A reply to Mitscherlich and Herz and Mitscherlich and Merres (this vol., ii, 614). The author prefers his own process (*Chem. Zeit.*, 1896, 20, 1032, 1033). The following process is recommended in the presence of any appreciable amount of nitrites: 0·5—2 grams of the substance, and so much potassium chlorate that there is one part of this to three parts of nitrous acid, are placed in a round-bottomed flask, 50 c.c. of water are added, and then drop by drop 3 c.c. of dilute sulphuric acid (1 : 2). After a quarter of an hour, 2—4 grams of reduced iron are added, and then 15 c.c. of the dilute acid (Ulsch's process), and when the reduction of the nitrate to ammonia is accomplished, the organic substances are destroyed by evaporating with 30 c.c. of sulphuric acid and a few drops of mercury (Kjeldahl method). A blank experiment should be made, once for all, to test the purity of the reagents used.

L. de K.

Detection of Nitrates in the Presence of Bromides. Villedieu (*J. Pharm. Chim.*, 1909, 30, 66—67).—When testing for nitrates in the presence of a large excess of bromides, it is advisable to remove the latter; this can, of course, be effected with silver sulphate, but in practice this is rather inconvenient on account of its slight solubility. The following test is recommended. The liquid, neutralised if necessary, is mixed with a slight excess of basic lead acetate, which precipitates nearly all the bromine, and the filtrate is then heated to boiling and the excess of lead precipitated by adding a little powdered sodium sulphate.

To the filtrate the usual test for nitrates with ferrous sulphate and sulphuric acid is then applied. L. de K.

Estimation of Phosphorus in Urine. G. C. Mathison (*Bio-Chem. J.*, 1909, 4, 233—239).—The estimation of total phosphorus in urine is best carried out by Plimmer and Bayliss's modification of Neumann's method; and inorganic phosphates by precipitation with magnesium citrate mixture, incineration, and calculation from the weight of the ash ($Mg_2P_2O_7$). Magnesia mixture gives incorrect results, owing to partial precipitation of calcium and of organic phosphorus. Organic phosphoric acid is determined by subtracting the inorganic from the total phosphoric acid, or by applying Neumann's method after the removal of inorganic phosphates. The uranium acetate method is inaccurate. Organic phosphorus must be estimated while the urine is fresh, as it decomposes in stale urine, especially if ammonia is present. It is readily dialysable. W. D. H.

Disappearance of Arsenic in the Form of Gaseous or Volatile Compounds during Putrefaction. Mario Tonegutti (*Boll. Chim. Farm.*, 1909, 48, 259—264, 370—374).—The author's experiments show that the putrefaction of protein substances containing arsenic is not accompanied by the evolution of arsenical gases, although very small proportions of organic arsenical products having basic or ptomaine characters are formed, which are volatile at a temperature above 30°, probably between 50° and 60°. The disappearance of arsenic from corpses in the form of gaseous compounds is hence improbable. T. H. P.

Gravimetric Estimation of Boric Acid. Kurt Arndt (*Chem. Zeit.*, 1909, 33, 725—726).—The process is intended for the estimation of small quantities of boric acid in fused alumina; 15 grams of potassium hydroxide are fused in a nickel crucible until the mass runs quietly, and, when cold, 3 grams of the impalpable powder are sprinkled over the surface. The mass is now again heated to redness for three hours, the crucible being covered. When cold, the contents are dissolved in water, slight excess of sulphuric acid is added, and the solution is introduced into a Gooch goose-neck apparatus. The authors have slightly modified this apparatus so that it holds fully 150 c.c. The boric acid is then expelled by repeated distillation with methyl alcohol, the distillate is evaporated, as directed by Gooch and Jones (Abstr., 1899, ii, 331), with a known weight of sodium tungstate, and the residue ignited and weighed.

When a solution of alumina and boric acid is mixed with ammonia,

a portion of the acid is retained obstinately by the precipitated hydroxide.
L. de K.

Estimation of Boric Acid. R. Mandelbaum (*Zeitsch. anorg. Chem.*, 1909, 62, 364—369).—The distillation of boric acid with methyl alcohol (Spindler, Abstr., 1905, ii, 480) may be used as an accurate method of estimation when modified. The borate, or substance containing borates, is warmed with 40% phosphoric acid, any carbon dioxide formed expelled by a current of purified air, the flask connected with a condenser, and a receiver containing a known excess of standard sodium hydroxide attached. Absolute methyl alcohol (150—170 c.c. for 0·2 gram B_2O_3) is run into the flask, which is then heated, a current of air saturated with methyl alcohol being bubbled through it. Finally, the sodium hydroxide flask is warmed to expel methyl alcohol, which distils through a second condenser into a receiver. The sodium hydroxide is then cooled, mixed with half its volume of glycerol, and titrated with sulphuric acid, phenolphthalein being used as indicator. The analysis occupies two to three hours.
C. H. D.

Elementary Analysis According to Carrasco-Plancher. Oreste Carrasco (*Chem. Zeit.*, 1909, 33, 733—734, 755—756).—An improvement of the apparatus described previously (Abstr., 1896, ii, 201). The copper oxide has been replaced by "platinum biscuit," and different combustion tubes are used according to the nature of the substance (solid, liquid, readily volatile, etc). Nitrogen-, sulphur-, and halogen-containing substances may also be analysed by means of the apparatus.
L. de K.

Simultaneous Estimation of the Residue and Combined Carbon Dioxide in Waters. K. Charitschkoff (*Chem. Zeit.*, 1909, 33, 670).—A slight modification of the Rohrbeck-Geissler apparatus for the estimation of carbon dioxide in carbonates from the loss sustained on adding hydrochloric acid.

The lower, basin-shaped, part of the apparatus may be removed and weighed, and serves for estimating the residue of the water in the ordinary way. The upper part of the apparatus is then put on, and the carbon dioxide is estimated as usual.
L. de K.

Estimation of the Alkalinity of Bleaching Powder Solutions. Kennedy P. Orton and W. J. Jones (*Analyst*, 1909, 34, 317—318).—A known volume of the solution is added to an excess of *N*/10-hydrochloric acid contained in a Drechsel bubbler, and a rapid current of pure air is drawn through for forty-five minutes, the solution being meanwhile carefully shielded from light. After ascertaining that the liquid is free from chlorine by testing a drop with a drop of 0·1% solution of methyl-orange, which should not be bleached, the excess of acid is titrated with *N*/10-sodium carbonate.

Allowance is then made for acid neutralised by the hypochlorite of the sample.
L. de K

A New Rapid Volumetric Method for the Estimation of Columbium in Presence of Tantalum, and its Application to the Analysis of Columbium Minerals. Floyd D. Metzger and C. E. Taylor (*Zeitsch. anorg. Chem.*, 1909, 62, 383—394).—Columbium and tantalum could only be separated hitherto approximately by fractional crystallisation of the potassium double fluorides. It is now found that when succinic acid is added to a solution of columbium and tantalum in concentrated sulphuric acid, the solution may be greatly diluted and heated without precipitation taking place. The columbium may then be reduced with zinc and titrated with permanganate, which does not act on succinic acid.

The zinc used for reduction should be amalgamated, 0·5 gram of mercury dissolved in 25 c.c. of nitric acid and diluted to 250 c.c. being used for 600 grams of zinc. In making an analysis, 0·2—0·5 gram of the mixed oxides is fused in a platinum crucible with 5 grams of potassium hydrogen sulphate, mixed with 10 grams of concentrated sulphuric acid, heated until dissolved, and cooled. The solution is transferred to a beaker, and the crucible rinsed with 30 c.c. of sulphuric acid. Two grams of succinic acid are added, the whole stirred, and 20 c.c. of a saturated aqueous solution of succinic acid added, with stirring. The solution is made up to 200 c.c. with water, and warmed to 75°. The Jones reduction apparatus, packed with amalgamated zinc, is rinsed with 200 c.c. of 5% sulphuric acid at 75°, and then filled with 20% acid at the same temperature. The columbium solution is run through the apparatus, which is then washed out with 50 c.c. of 20% acid and 200 c.c. of 5% acid. The brown reduced solution is titrated with permanganate in an atmosphere of carbon dioxide. One c.c. $N/10\text{-}KMnO_4 = 0{\cdot}007052$ gram Cb_2O_5. The reaction corresponds with a reduction to $Cb_2O_{3\cdot107}$. In the analysis of minerals, the volumetric method gives lower values for columbium and correspondingly higher values for tantalum than the method of fractional crystallisation. It is more exact than the latter. C. H. D.

Estimation of Lead in Tinned Utensils, etc. Franz Knöpfle (*Zeitsch. Nahr. Genussm.*, 1909, 17, 670).—The usual method of separating lead from tin in alloys by treating the latter with nitric acid and dissolving the lead nitrate from the metastannic acid cannot be employed if the alloy contains much iron, as the ferric nitrate dissolves a portion of the metastannic acid, which is re-precipitated with the lead when the latter is estimated as sulphate. The following method is therefore proposed: From 0·5—1·0 gram of the alloy is treated in a porcelain basin with nitric acid, D 1·50 to 1·52, exactly 1 c.c. of the acid being used for each 0·1 gram of metal. The basin is then covered with a clock-glass, and water is added drop by drop until red vapours no longer appear. The excess of acid is next evaporated on the water-bath, so as to leave a moist residue, to which is added a sufficient quantity of hot sodium phosphate solution and about 50 c.c. of hot water. The crystalline precipitate of stannic phosphate is collected on a filter, and the lead is then estimated in the filtrate in the usual way as sulphate. W. P. S.

Colorimetric Estimation of Lead in the Presence of Iron; Preparation of Lead-free Reagents by means of Ferric Hydroxide. JOHN M. WILKIE (*J. Soc. Chem. Ind.*, 1909, 28, 636—638).—Lead is precipitated completely from its solutions by ammonia provided there is a sufficiency of ferric iron present; this fact enables lead-free ammonium chloride, etc., to be prepared.

When estimating lead colorimetrically in presence of iron with sodium sulphide by Teed's method (Abstr., 1893, ii, 242), the author finds it necessary to reduce any iron to the ferrous state, and this is effected most conveniently by boiling the acid solution with a little sodium thiosulphate until colourless Some potassium cyanide is then added, followed by excess of ammonia. Addition of tartaric acid is superfluous. L. DE K.

Precipitation of Copper Oxalate in Analysis. FRANK A. GOOCH and H. L. WARD (*Amer. J. Sci.*, 1909, [iv], 27, 448—458).—A study of the best conditions to effect a complete precipitation of copper as oxalate, and containing a large number of experiments, the results of which are tabulated.

The best and most convenient procedure for the precipitation of either small or large amounts of copper consists in adding 2 or 4 grams of oxalic acid to 50 or 100 c.c. of the 5% acetic acid solution of the copper salt containing 5 or 10% of nitric acid. The precipitate is afterwards titrated with permanganate in presence of sulphuric acid. L. DE K.

The Volumetric Estimation of Mercuric Salts. H. MORAWITZ (*Zeitsch. anorg. Chem.*, 1909, 62, 310—312. Compare this vol., ii, 185).—A reply to the criticisms of Andrews (this vol., ii, 440).

C. H. D.

Electro-chemical Behaviour of Manganese. C. NICOLESCU OTIN (*Zeitsch. Elektrochem.*, 1909, 15, 385—386).—In estimations of manganese by Engels's method (electrolysis of a solution containing chrome alum and sodium acetate with an anodic current density of 0·006 to 0·01 ampere per sq. cm.), the author used a cathodic current density of about 0·05 ampere per sq. cm., and obtained some 7% of the manganese in the metallic form. He finds that this is prevented by using a low current density at the cathode, or by adding ammonium sulphate (about 2 grams per 100 c.c.) to the solution.

T. E.

Electrolytic Estimation of Manganese. C. NICOLESCU OTIN (*Zeitsch. Elektrochem.*, 1909, 15, 386—389).—The deposit formed at the anode when a solution of a manganese salt and of ammonium sulphate (1 to 2 grams) is electrolysed, is shown to have the composition MnO_2 (after drying at 200—220°). Except in very small quantities, however, it does not adhere well to the matt platinum basin used as anode. This difficulty is overcome by adding from 3 to 8 c.c. of alcohol. Quantities up to 1·1 gram of MnO_2 may be estimated in this way, using an anodic current density of about 0·04 ampere per sq. cm. at 60°, or 8 or 10 times less at the ordinary temperature. T. E.

Estimation of Iron by Permanganate in Presence of Hydrochloric Acid. G. Cecil Jones and John H. Jeffery (*Analyst*, 1909, 34, 306—316).—The old method recommended by Fresenius gives untrustworthy results. The method proposed by Reinhardt (Abstr., 1890, 296) may, however, be employed advantageously as follows. The iron oxide is dissolved in 25 c.c. of hydrochloric acid, D 1·1, and reduced with as little stannous chloride solution as possible. Ten c.c. of saturated mercuric chloride are then added, and after ten minutes it is poured into 10 c.c. of Reinhardt's solution and diluted with water to 400 c.c. The liquid is then titrated with standardised permanganate; it is absolutely necessary that this should be added very slowly, drop by drop. The Reinhardt solution is prepared as follows: 200 grams of crystallised manganous sulphate are dissolved in 1000 c.c. of water, and a cooled mixture of 400 c.c. of sulphuric acid and 600 c.c. of water are added, also 1000 c.c. of phosphoric acid, D 1·13. L. de K.

Reduced Iron. Virgil Coblenz and Otto B. May (*Zeitsch. angew. Chem.*, 1909, 22, 1224—1227).—A criticism of the processes in use for the assay of reduced iron, the value of which depends on the percentage of actual metallic iron. The iodine titration process, and the methods based on the use of copper sulphate, are described, and the results communicated in a table.

The following process used in steel analysis seems promising; it is based on the estimation of the oxidised iron and siliceous impurities. One hundred and seventy c.c. of a nearly saturated solution of potassium cupric chloride and 5 grams of citric acid are placed in a flask, and 3 grams of the sample are added. After shaking for some time at a temperature not exceeding 15·5°, the undissolved iron oxides, etc., are collected, washed with cold water, and then with a weak solution of citric acid until free from copper. The mass is then dried, ignited, and weighed as ferric oxide. L. de K.

Analysis of Special Steels. J. Pepin Lehalleur (*Mon. Sci.*, 1909, 23, i, 263).—In the analysis of steels containing molybdenum, vanadium, wolfram, nickel, and chromium, the separation of the first of these metals from the others by means of ether should be carried out in hydrochloric acid solution (D 1·12). The ether is distilled off, and the residue evaporated with sulphuric acid. The warm aqueous extract is treated with hydrogen sulphide, and the precipitated sulphide ignited in a stream of hydrogen sulphide, but not in hydrogen, as this reduces the product to a sulphide lower than that corresponding with MoS_2.

Vanadium is precipitated in ammoniacal solution as manganese vanadate, and redissolved in concentrated hydrochloric acid. Chromium is reduced from the chromate by ferrous ammonium sulphate, and the excess of this salt titrated with permanganate. Tungsten is estimated by attacking the alloy with concentrated hydrochloric acid, evaporating to dryness twice with nitric acid, and then with hydrochloric acid and potassium chlorate. The residue is dissolved in boiling dilute hydrochloric acid, and the liquid (A) decanted on to an ashless filter; the insoluble residue is treated with boiling dilute ammonium hydroxide, when tungstic acid is dissolved together with a little silica. The liquid is poured on to the preceding filter, washed with dilute ammonium hydroxide, and the liquid collected in another vessel. The ammoniacal filtrate is concentrated, transferred to a tared platinum crucible, and evaporated to dryness with nitric acid until the residue is yellow. The crucible and contents are weighed, treated with hydrofluoric and sulphuric acids, and re-weighed, the loss giving the silica which has been volatilised. The filter paper is ignited and weighed, treated with hydrofluoric acid, and the remainder of the silica thus estimated. The residue is fused with sodium hydrogen sulphate, extracted with water, and added to the liquid (A), in which chromium is estimated by one of the usual methods. The nickel (after precipitation as sulphide) is estimated by electrolysis in ammoniacal solution with a maximum current of 4 amperes. F. M. G. M.

Microchemical Reaction of Cobalt; Nickel and Cobalt Dimethylaminobenzeneazobenzenesulphonates. M. EMMANUEL POZZI-ESCOT (*Ann. Chim. anal.*, 1909, **14**, 207—208).—The nickel compound when crystallised from hot water, in which it is only sparingly soluble, forms lustrous, yellow, hexagonal tablets. Magnesium also yields a similar precipitate, but this becomes crystalline in the cold, and the crystals are smaller than those of nickel.

The cobalt compound crystallises both from hot and cold solutions in long, slender prisms, forming long needles of a violet or black colour, often grouped in stars; when obtained from a rapid evaporation, small needles are formed, grouped in palisade-like form. The colour and size distinguish the cobalt crystals sufficiently from similar crystals of other metals. L. DE K.

Estimation of Nickel and Cobalt according to Rosenheim-Huldschinsky. MAX PRITZE (*Chem. Zeit.*, 1909, **33**, 694).—This process is based on the fact that cobalt–ammonium thiocyanate is soluble in a mixture of amyl alcohol and ether, whilst the nickel compound is not. When the solution, however, contains 50 or 100 times more nickel than cobalt, a small portion of nickel is also extracted. In order to free the cobalt completely from nickel, the author prefers treatment with dimethylglyoxime to a second shaking with the amyl alcohol–ether mixture. L. DE K.

The Estimation of Vanadium in Steel. ÉMILE JABOULAY (*Rev. gen. Chim. pure appl.*, 1909, **12**, 142).—This method is based on the fact that when a solution containing hypovanadic acetate and a large excess of ferrous acetate is boiled in contact with air, oxidation takes place and a precipitate is slowly formed which contains the vanadium, iron, and any chromium which may be present.

Modifications of the method, which are to be used when chromium, tungsten, molybdenum, or other metals are present, are also described in detail. F. M. G. M.

Estimation of Bismuth in "Bismuthum Tribromophenylicum." O. SCHLENK (*Pharm. Zeit.*, 1909, **54**, 538).—One to

two grams of the sample are heated to boiling with 20 c.c. of 10% sodium hydroxide solution until the bismuth hydroxide has separated. The liquid is diluted with water, and after decanting it through a filter, the precipitate is again treated repeatedly with the hot alkali, until this no longer gets turbid on adding hydrochloric acid (absence of tribromophenol). The precipitate is now collected on the filter, thoroughly washed with hot water, and then burnt with the filter in a porcelain crucible. It is then moistened with nitric acid, dried, and once more ignited.
L. DE K.

Comparison of the Iodide and Lime Methods for the Estimation of Glycerol in Wine. J. SCHINDLER and H. SVOBODA (*Zeitsch. Nahr. Genussm.*, 1909, **17**, 735—741).—The iodide method described by Zeisel and Fanto (Abstr., 1902, ii, 585; 1904, ii, 95) for the estimation of glycerol in wine was found by the authors to be trustworthy and rapid; the apparatus devised by Stritar (Abstr., 1904, ii, 95) is of considerable use in carrying out the process. The lime method, in the case of dry wines or wines which do not contain more than 5 grams of sugar per 100 c.c., yields concordant results; the latter are, however, somewhat lower than those obtained by the iodide method. Possibly the loss of glycerol during evaporation is balanced by the presence of impurities. Preference must be given to the iodide method in the case of sweet wines, as the lime method gives results which are too low.
W. P. S.

Estimation of Glycogen and Starch; Detection of Horse Flesh in Sausages. MAURICE PIETTRE (*Ann. Chim. anal.*, 1909, **14**, 206—207).—Twenty-five grams of the contents of the sausage are boiled in a reflux arrangement with 80 or 90 c.c. of alcoholic potassium hydroxide (aqueous potassium hydroxide, D 1·3, 20 c.c.; absolute alcohol, 80 c.c.), which removes the fatty and protein matters. The residue is collected on a filter, and washed first with hot 80 vol.% alcohol, and then with cold alcohol slightly acidified with hydrochloric acid until nearly the whole of the alkali is removed.

The mass is then heated with slightly alkaline water, which dissolves both starch and glycogen. On adding an equal volume of alcohol, the starch is precipitated, and may be collected and washed with cold 50 vol.% alcohol; the filtrate is then concentrated to a small volume, and the glycogen precipitated by adding excess of absolute alcohol. It may be recognised by its flocculent appearance and brown colour, and by the reaction with iodine in acetic acid solution. If desired, it may be collected, washed with alcohol, dried, and weighed.
L. DE K.

The Estimation of Mineral Acids in Vinegar. FERNAND REPITON (*Mon. Sci.*, 1909, [iv], **23**, i, 172).—A criticism of the work published by Richardson and Bower (*J. Soc. Chem. Ind.*, 1906, **25**, 836) on the same subject. The author considers his methods simpler and his results quite as accurate as those obtained by the above workers.
F. M. G. M.

Estimation of Fatty Acids in Soaps. M. DOMINIKIEWICZ (*Chem. Zeit.*, 1909, 33, 728).—Ten c.c. of soap solution (=about 0·5 gram of soap) are decomposed by heating with 10 c.c. of hydrochloric acid on the boiling water-bath for five minutes, and then centrifugalised for five minutes in a specially constructed apparatus (resembling a butyrometer). The fatty layer is then read off on a scale (temp. 99°); each division =0·01 gram of acids. As, however, the sp. gr.'s of the acids are less than that of water, a correction must be applied when calculating the percentage by weight. In practice, the sp. gr.'s of fatty acids used in soap-making may be taken as about 0·835 (temp. 99°). L. DE K.

Estimation of Lactic Acid in Urine. JOHN H. RYFFEL (*Proc. physiol. Soc.*, 1909, v—vii; *J. Physiol.*, 39).—The urine is first steam-distilled with rather over 50% of sulphuric acid; the lactic acid then yields acetaldehyde quantitatively. The acid distillate is then just made alkaline and redistilled; to the distillate, Schiff's reagent (rosaniline hydrochloride bleached with sulphur dioxide) is added, and the depth of colour compared by a colorimeter with that obtained with the reagent and standard formaldehyde solution. W. D. H.

Reactions of Oxalates. TARAK NATH DAS (*Chem. News*, 1909, 99, 302).—For the analysis of salts containing oxalates, the following method is advocated as being more expeditious than the usual operation of ignition. The precipitate obtained in the course of analysis by adding ammonium chloride and ammonia is dissolved in nitric acid, and the decomposition of all oxalates and their conversion into nitrates is effected by adding excess of potassium chlorate and boiling for a few minutes.

Oxalates may be detected when in presence of carbonates, sulphites, etc., by treating the mixture with dilute nitric acid until the evolved gas no longer renders lime water cloudy (separation from carbonates), adding excess of potassium chlorate, and again boiling; if the lime water is now turned cloudy, the presence of oxalate may be inferred. J. V. E.

Estimation of the Volatile Organic Acids of Tobacco and the Behaviour of the Oxalic Acid. RICHARD KISSLING (*Chem. Zeit.*, 1909, 33, 719—720).—A criticism of Tóth's method (Abstr., 1908, ii, 238, 330; this vol., ii, 446). Tóth's statement that malic, citric, and oxalic acids yield an acid distillate on boiling with addition of sulphuric acid is erroneous. Oxalic acid is not decomposed on repeated evaporation with water, but the dry residue on being heated at 100° gradually volatilises by sublimation. When malic and citric acids are also present, the oxalic acid is but very imperfectly expelled. Acetic acid, if present, may be readily got rid of by heating on the water-bath until the odour is completely gone. L. DE K.

Detection of Benzoic Acid in Foods. Mlle. ANNA JONESCU (*J. Pharm. Chim.*, 1909, [vi], 30, 16—17).—In a private communication to the author, Leys has claimed priority for the discovery of the hydrogen peroxide test for benzoic acid, described recently by the author (this vol., ii, 627). Leys' memoir (Abstr., 1901, ii, 488) only gives precise directions for the detection of "saccharin" by this method, and the author's object was to indicate that benzoic acid could be readily isolated from foods containing it and be detected by this test. T. A. H.

Detection of Benzoic Acid in Meats and Fats. KARL FISCHER and O. GRUENERT (*Zeitsch. Nahr. Genussm.*, 1909, 17, 721—734).—In the method proposed, the benzoic acid, after it has been extracted from the substance under examination, is converted in part into salicylic acid by fusion with sodium hydroxide, and the presence of the latter ascertained by the well known coloration produced with ferric chloride. Fifty grams of the finely divided meat, or molten fat, are well mixed with 100 c.c. of 50% alcohol, acidified with sulphuric or hydrochloric acid (in the case of fats, the use of 20% alcohol is recommended); the alcoholic solution is then separated, rendered alkaline, and evaporated until the alcohol has been removed. The residual liquid is diluted to a volume of 50 c.c., 5 grams of sodium chloride are added, the mixture is acidified with sulphuric acid, heated to boiling, cooled, and extracted with ether. The ethereal extract is evaporated, the residue is fused in a silver crucible with a little sodium hydroxide, and the fused mass is dissolved in water. The solution obtained is acidified with sulphuric acid, extracted with ether, and the residue obtained on evaporating the ether is tested with a drop of 0·5% ferric chloride solution. The method will detect the following quantities of benzoic acid: in fresh meat, 0·01%; in smoked meats, 0·02%; in lard, butter, etc., 0·005%. The test described by Brovans (Abstr., 1902, ii, 112) is stated to be useless for the detection of benzoic acid in meats and fats. Tests which are based on the conversion of benzoic acid into benzaldehyde are capable of detecting the presence of 0·04% of the acid in fresh meats, but not in smoked meats; they are unsatisfactory in the case of fats. W. P. S.

The Schardinger Reaction for Milk. KURT SCHERN (*Biochem. Zeitsch.*, 1909, 18, 261—284).—Schardinger has shown that milk at 45° decolourises a reagent containing methylene-blue and formaldehyde. This reaction is apparently due to the presence of an enzyme, as it is not produced if the milk is boiled previously. The author shows however, that the Schardinger reaction is not produced by all milks. Milk from cows in the earlier stages of lactation is inactive. The activity, however, increases with the stage of lactation, and is generally given with milk from cows in the later stages. For these reasons, the Schardinger reaction must be applied with care to milk examined for hygienic purposes. S. B. S.

The Quantitative Estimation of Diphenylamine. DREGER (*Zeitsch. ges. Schiess, Sprengstoffwesen*, 1909, 4, 123).—When diphenylamine is brominated in alcoholic solution, *tetrabromodiphenylamine*, red needles, m. p. 102°, is precipitated on the addition of water. It is insoluble in water, sparingly soluble in alcohol, but soluble in the ordinary organic media. The quantitative estimation is carried out as follows. An alcoholic solution of commercial diphenylamine is slowly treated with an excess of bromine in alcohol until no further precipitate is produced. About twice the volume of water is added with stirring, and the mixture heated until the alcohol and excess of bromine are removed and the precipitate becomes granulated; this is collected in a tared Gooch crucible, washed with warm water, and dried at 98—100°. F. M. G. M.

Estimation of Urea in Urines. Phœbus A. Levene and Gustave M. Meyer (*J. Amer. Chem. Soc.*, 1909, **31**, 717—722).—An objection to Benedict and Gephart's method (this vol., ii, 103) is the partial hydrolysis of the uric acid and creatinine by the hydrochloric acid at 150°. The authors overcome the difficulty by removing the basic substances by means of phosphotungstic acid. In the modified method, 12·5 c.c. of urine are placed in a 50 c.c. flask, and a 10% solution of phosphotungstic acid in 10% sulphuric acid is added slightly in excess of the amount required to precipitate the basic substances. After twenty-four hours, the volume is made up to 50 c.c. with 10% sulphuric acid. The solution is filtered, and 20 c.c. of the filtrate are heated in an autoclave as in Benedict and Gephart's method.

C. S.

Isolation of Conium Alkaloids from Animal Tissues. Walter J. Dilling (*Bio-Chem.* 1909, *J.*, **4**, 286—299).—The most satisfactory method for the isolation of coniine from animal tissues to which it has been added is that of distillation. Coniine appears to be decomposed both by the action of living cells and during putrefaction. Conhydrine and ψ-conhydrine can be isolated by extraction with alcohol and precipitation by phosphotungstic acid, but the results are inconstant.

W. D. H.

Factors which Influence the Estimation of Creatinine. F. C. Cook (*J. Amer. Chem. Soc.*, 1909, **31**, 673—693).—Folin's colorimetric method for the estimation of creatinine (Abstr., 1904, ii, 375) gives satisfactory results for the total creatinine in beef extracts and similar products, but is not trustworthy for the estimation of the original creatinine in meat products. After a brief historical discussion of the colour reaction which takes place when a creatinine solution is treated with picric acid and an alkali, the author tabulates the results of experiments on solutions of meat extract, creatine, and creatinine to ascertain what is the influence on the colour of the amount of picric acid and of alkali, and also the influence of dilution, of keeping, of coagulable proteins, and of proteoses and peptones. The results show that in all cases in Folin's method it is desirable to take 25 or 30 c.c. of 1·2% picric acid solution, and 10 c.c. of 10% sodium hydroxide. The values for creatine and creatinine, alone, in meat, or in meat extract, are lowered by dilution; the error appears to be fairly constant, and averages 0·00019 gram of creatinine per 10 c.c. of dilution. Before taking readings, the solution should remain five minutes after adding the reagents. The presence of coagulable protein, or of proteoses and peptones, lowers the values for solutions containing creatine, creatinine, or meat extract. The autoclave method of Benedict and Myers (Abstr., 1907, ii, 492), modified so as to be applicable to meat products, gives the most satisfactory results in estimating creatine. C. S.

New Reactions of Hydrastine, Hydrastinine, and Narcotine. A. Labat (*Bull. Soc. chim.*, 1909, [iv], 5, 742—743).—When 0·1 c.c. of solutions of hydrastine (0·33%), hydrastinine (1%), or narcotine (1%) in 10% sulphuric acid is added to 2 c.c. of sulphuric acid, and the mixture heated on a water-bath with 0·1 c.c. of solutions of certain phenols, very beautiful colorations are produced. With a 5% alcoholic solution of gallic acid, the colour is an intense emerald-green, which gradually becomes blue. The absorption spectrum of the liquid exhibits bands in the red and between the red and yellow, the latter of which disappears more quickly on dilution. The solution when diluted with glacial acetic acid becomes violet. With a 5% guaiacol or catechol solution, a currant-red colour is first developed, which becomes violet. Finally, in the case of a 2% solution of morphine hydrochloride, the mixture gradually becomes violet.

The reaction with gallic acid is the most sensitive, being recognisable with 1 part of hydrastinine, hydrastine, or narcotine in 50,000, 40,000, or 20,000 parts of water respectively.

The reactions confirm the close analogies supposed to exist between the constitution of the three alkaloids. E. H.

New Reactions of Opianic Acid and their Applications to the Detection of Hydrastine and Narcotine. A. Labat (*Bull. Soc. chim.*, 1909, [iv], 5, 743—745. Compare preceding abstract).—When a sulphuric acid solution of hydrastine or narcotine is oxidised with potassium permanganate, appreciable quantities of opianic acid are produced. By adding 0·1 c.c. of a 1% alcoholic solution of the latter acid to 2 c.c. of pure sulphuric acid, and treating the mixture with 0·1 c.c. of a solution of certain phenols, colorations are obtained. With a 5% solution of gallic acid a blue coloration is produced, and changes to the colour of dead leaves on heating on a water-bath. A 5% alcoholic guaiacol solution gives a currant-red colour, which changes to an intense blue on the water-bath, whilst the absorption spectrum of the solution then has bands in the red, between the red and the yellow, in the green, and between the green and the blue; these disappear on dilution in the reverse order to that in which they are given. Similar colorations are obtained with catechol. Similarly, with 20% alcoholic solutions of α- and β-naphthol, currant-red and wine-red colours are produced respectively. A 5% alcoholic solution of codeine gives a violet coloration which gradually changes to blue on a water-bath. An intense violet tint, becoming paler on the water-bath, is obtained with an alcoholic solution (2·5%) of β-methoxynaphthalene. E. H.

Estimation of Quinine and its Excretion in the Urine. M. Nishi (*Arch. exp. Path. Pharm.*, 1909, 60, 312—323).—Acid quinine citrate ($C_{20}H_{24}O_2N_2,C_6H_8O_7$) can be prepared by saturating quinine with citric acid in ethereal solution, and the preparation of this compound renders the estimation of quinine an easy matter. In the urine, the quinine is first extracted with ether after the urine is made strongly alkaline. About 34·5% of the quinine given is recoverable in the urine, and the greater part of this (25·5%) is excreted during the first twenty-four hours. If the quinine is given by the mouth in combination with arsenic or iron, the absorption and excretion of quinine are not affected. W. D. H.

Micro-chemical Detection of Alkaloids, particularly in the Leaves of Pilocarpus pennatifolius. O. Tunman (*Chem. Zentr.*, 1909, i, 1510—1511; from *Schweiz. Woch. Chem. Pharm.*, 1909, 47, 177—183).—The reagents are applied directly to the cells. Zinc chloride–iodine forms dark black droplets, which exhibit rapid motion, but dissolve after fifteen minutes. The disadvantage of this test is that the strong cellular walls of the epidermis is also attacked. If the preparations are soaked for a few seconds in a drop of dilute nitric acid (1 : 5) and then placed on another object glass with a little absolute alcohol, a crystalline deposit of pilocarpine nitrate will be noticed. When moistened on a slide with potassium mercuric iodide, and then with a few drops of hydrochloric acid, a grey, amorphous precipitate is formed. Solution of iodine in potassium iodide (1 part of each to 200 parts of water) causes in the pilocarpine-containing cells numerous dark brown or reddish-brown, lustrous, oily droplets, which unite to larger drops and then soon disappear. With slightly acidified iodine solutions, finely granulated masses are obtained. The same occurs with potassium bismuth iodide, but the precipitates are then of a bright red colour.

The author describes how the pilocarpine alkaloids are distributed. In the inner tissues some cells give decided reactions for alkaloids, whilst neighbouring tissues do not contain a trace. L. de K.

A New Method for Detection of Indole in Culture Media. G. Morelli (*Zentr. Bakt. Par.*, 1909, i, 50, 413—415).—Indole gives a red coloration with oxalic acid. The test for indole is carried out by hanging a piece of filter paper, which has been dipped in saturated oxalic acid and then dried and sterilised, just above the culture medium. S. B. S.

Detection of Coal-tar Colours in Wine by means of the Reaction between Iodine and Tannin. Carlo Conti (*Boll. Chim. Farm.*, 1909, 48, 295—298).—A solution of tannin absorbs iodine, giving a liquid which does not react with starch paste, and, if not saturated with iodine, does not evolve iodine when distilled almost to dryness. When iodine is added to a red wine, all the natural colouring matter of the latter is precipitated, the reaction proceeding rapidly and completely in the warm. This reaction is applied to the detection of coal-tar dyes in wines, the procedure being as follows.

One hundred c.c. of the wine are freed completely from alcohol by evaporation, the cold residue being made up to the original volume with water. To the liquid, heated at 40—50° on a water-bath and shaken, a 2% solution of iodine in potassium iodide solution is added until, on testing with starch paper, the coloration does not remain constant. The solution is heated in a water-bath so long as the precipitate does not become flocculent or assume an orange-red colour; it is then left for three to four hours and filtered. To 10 c.c. of the filtrate is added, drop by drop, a slight excess of sodium thiosulphate solution. Natural wine then appears pale yellow, whilst wine coloured artificially with an acid dye is rendered more or less red; the latter colour becomes more evident if the acid of the wine precipitates free sulphur from the excess of thiosulphate. In this way 1 part of colouring matter per 100,000 of wine is rendered evident. Should the coloration be doubtful, a thread of fat-free wool is boiled for twenty minutes in a portion of the residual liquid acidified with a few drops of hydrochloric acid. The wool is removed, well washed, and gently heated in dilute sodium thiosulphate solution. With a natural wine, the wool then has a yellow colour, whilst with a wine artificially coloured, it has a distinct red colour. This modification detects 1 part of colouring matter per 400,000 of wine. T. H. P.

Detection of Urobilin in Urine. P. Guigues (*Chem. Zentr.*, 1909, 1, 1273; from *Bull. Sci. Pharm.*, 1909, 16, 88—89).—The author proposes to precipitate the urobilin by saturating the urine with ammonium sulphate after acidification with hydrochloric acid. The precipitate is washed with a saturated solution of ammonium sulphate, dried in a vacuum over sulphuric acid or calcium oxide, and then extracted with hot ethyl acetate. The solution which contains the urobilin is examined spectroscopically. The chief absorption bands lie between green and blue from $\lambda = 502—482$ or $501—483$. If zinc acetate is added, the bands move towards $\lambda = 517—497$.

L. de K.

Estimation of the Oxidation Numbers of Urine with Potassium Permanganate. Hille (*Chem. Zentr.*, 1909, 1, 1201; from *Apoth. Zeit.*, 1909, 24, 146—147).—The oxidation number of a urine is the number of mg. of oxygen absorbed by 1 c.c. of the sample. The operation, which is the same as in the Kubel process for the estimation of organic substances in water, is carried out as follows: 10 c.c. of diluted urine (10 grams : 100 c.c.) are mixed with 50 c.c. of water and 25 c.c. of dilute sulphuric acid (1 : 2), and heated to boiling. *N*/10-Permanganate is then added until the liquid is dark red, and the heating is continued for ten minutes. To the solution, which must still be decidedly red, 10 c.c. of *N*/10-oxalic acid are added, and then, again, permanganate until the liquid is permanently coloured after ten minutes boiling.

The oxidation numbers of normal urines seem to lie between 4 and 11. Diabetic and other abnormal urines absorb from 13—14 mg. of oxygen. L. de K.

General and Physical Chemistry.

Ultra-violet Band Spectrum of Phosphorus. ANTOINE DE GRAMONT and CHARLES DE WATTEVILLE (*Compt. rend.*, 1909, 149, 263—266).—Attention is called to the agreement in the constitution of the ultra-violet spark and flame spectra obtained independently by the two authors in operating with a solution of phosphoric acid. The results are tabulated in parallel tables. H. M. D.

Absorption, Fluorescence, Magnetic Rotation, and Anomalous Dispersion of Mercury Vapour. ROBERT W. WOOD (*Physikal. Zeitsch.*, 1909, 10, 466—471*).—The emissive and absorptive properties of mercury vapour have been examined, more especially in reference to the properties of the absorption band at λ 2536. The changes which take place in the absorption spectrum as the density of the vapour increases have been ascertained by means of photographic records.

The fluorescence spectrum of mercury vapour varies with the nature of the sparking electrodes, and the observations indicate that the line λ2536 is due to the action of rays of very small wave-length. These rays are present in the spark spectrum of cadmium, but not in that of zinc. With rise of temperature the intensity of the fluorescence spectrum gradually diminishes, and ultimately the spectrum disappears.

The band at λ 2536 exhibits strongly developed anomalous dispersion. In accord with the asymmetry of the band, it is found that the magnetic rotation of the plane of polarisation is very largely altered in the neighbourhood of the band on the ultra-violet side, whereas on the other side of the band the rotation is not perceptibly increased. H. M. D.

Anomalous Rotation Dispersion. HERMANN GROSSMANN (*Ber.*, 1909, 42, 2646—2648. Compare Tschugaeff, this vol., ii, 631).—The effect of the solvent on the rotation dispersion of ethyl tartrate has been examined, and the following numbers obtained for [*a*].

	Red.	Yellow.	Green.	Pale blue.	Blue.
Pure ester	+6·96	+7·29	+7·50	+6·60	+5·67
In chlorobenzene	+8·23	+8·67	+9·50	+8·33	+7·50
In benzyl alcohol	+17·8	+20·2	+24·2	+26·6	+27·4
In pyridine	+33·4	+38·7	+49·0	+55·8	+60·5
In tetrachloroethylene ...	+2·71	+1·93	+0·58	−1·42	−4·43
In tetrachloroethane	−6·29	−8·93	+13·14	−17·37	−22·33

J. J. S

Action of Gravity on the Induced Activity of Radium. LOUIS WERTENSTEIN (*Compt. rend.*, 1909, 149, 268—271. Compare Curie, Abstr., 1907, ii, 728).—From an examination of the rate of decay of the induced activity of radium deposited under the influence of gravity, it is shown that radium-*A* is entirely absent. This has evidently been transformed in the time required for the deposition of the active particles. In further experiments described by the author, parallel plates were placed horizontally at different distances from one another, and exposed to radium emanation in a closed vessel. The decay curves obtained by examination of the induced activity deposited on the inner faces of the upper and lower disks differ in general very considerably. The difference depends on the distance between the parallel plates, and for a given distance it depends on the hygrometric condition of the air.

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* and *Phil. Mag.*, 1909, [vi], 18, 240—249.

H. M. D.

Chemical Action of Penetrating Radium Rays on Water. Miroslaw Kernbaum (*Compt. rend.*, 1909, 149, 116—117. Compare this vol., ii, 364).—The action of the β- and γ rays of 0·1 gram of radium chloride on 30 c.c. of distilled water during forty-one days produced 165 cub. mm. of hydrogen without a trace of oxygen. By titration of the water with very dilute potassium permanganate, it was established with a possible error of 10% that the equivalent of oxygen remained in the water as hydrogen peroxide. The decomposition of water according to the equation $2H_2O = H_2O_2 + H_2$ requires 0·66 Cal. per 165 cub. mm. of hydrogen liberated, whence it follows that only 1/17,500 of the total energy developed by the radium was utilised in decomposing the water. In an experiment with a glass container having thinner walls, this fraction was increased to 1/11,600.

A powerful beam of Röntgen rays acting under exactly parallel conditions for one hundred hours failed to produce either hydrogen or hydrogen peroxide. The conclusion is drawn that the decomposition of water by radium is mainly, if not entirely, the work of β-rays. The simultaneous production of hydrogen and hydrogen peroxide is an abnormal phenomenon, although peroxide alone is formed, for example, by the contact of water with certain heavy metals. R. J. C.

Evolution of Radium Emanation. H. Herchefinkel (*Compt. rend.*, 1909, 149, 275—278).—The proportion of radium emanation which is evolved from solid radium salts, or barium salts containing radium, is very small compared with the proportion of actinium emanation which is separated from the rare earth salts which usually accompany actinium. With the object of obtaining information in regard to this difference in behaviour, the author has measured the quantity of emanation evolved by various precipitated substances containing radium. These include hydroxides, fluorides, chromates, oxalates, and sulphates, which were dried for twenty-four hours at 110° before being sealed up in tubes for the determination of the emanation which they give up. Whereas barium salts generally retain the emanation to a marked extent, it is possible to obtain a much larger proportion of the total emanation formed from the radium present, when this is associated with the hydroxides of iron or uranium, with ferric chromate or didymium fluoride. H. M. D.

Ratio between Uranium and Radium in Radioactive Minerals. Mlle. Ellen Gleditsch (*Compt. rend.*, 1909, 149, 267—268).—The method used by the author for the estimation of radium in radioactive minerals (this vol., ii, 533) has been examined for possible sources of error, and found to give trustworthy results. The values obtained for the ratio of radium to uranium in French autunite, Joachimsthal pitchblende, and Ceylon thorianite are respectively 2·85, 3·58, and $4 \cdot 19 \times 10^{-7}$. These results indicate that the ratio is variable within certain limits, and various hypotheses relating to the variability are discussed. In view of these observations, the number obtained for the average life of uranium on the assumption of a constant ratio cannot be accepted as correct. H. M. D.

Isolation and Relative Activity of Uranium-*X*. BÉLA SZILARD (*Compt. rend.*, 1909, 149, 113—115. Compare Schmidt, this vol., ii, 206).—The presence of traces of iron is advantageous in precipitating certain radioactive products, including uranium-*X*, by means of barium sulphate. Pure barium sulphate hardly precipitates any uranium-*X* in absence of uranium and iron (compare Moore and Schlundt, Abstr., 1906, ii, 721), whereas ferric hydroxide carries down uranium-*X* very easily. Uranium acetate solution with addition of ferric acetate, ammonium acetate, and a little acetic acid is boiled for a few minutes and filtered hot. The precipitate of ferric hydroxide is washed, redissolved in acetic acid, and partly precipitated by the same process. Or, the first precipitate is dissolved in hydrochloric acid and the iron extracted with alcohol-free ether, leaving the uranium-*X* in the aqueous solution. On repeating the separation of uranium-*X* from the same lot of uranium daily for twelve days, the activity of the last four precipitates was constant, and equal to only 4% of the total uranium-*X* activity. It is therefore assumed that the residual uranium was practically free from uranium-*X*. Ionisation measurements show that the uranium-*X* in equilibrium with uranium is responsible for 0·237 of the total radioactivity. If it is assumed that uranium is decomposed 2,000,000 times as slowly as radium, only $2 \cdot 10^{-11}$ grams of uranium-*X* would be present in 1 gram of uranium in equilibrium. Pure uranium-*X* must then be ten milliard times as active as uranium in equilibrium. R. J. C.

Radioactivity of Compounds of Erbium, Potassium, and Rubidium. W. W. STRONG (*Amer. Chem. J.*, 1909, 42, 147—150).—A number of minerals and salts of the rarer elements have been examined for radioactivity by placing them in dishes covered with a screen containing several openings, above which a photographic plate is exposed to the salt below for about six months. The salts were collected about fifteen years ago, and include those of potassium, zirconium, cæsium, lead, bismuth, yttrium, tungsten, sodium, molybdenum, niobium, rubidium, erbium, tantalum, lanthanum, vanadium, neodymium, prascodymium, and ruthenium. The majority of the potassium salts and all of the erbium and rubidium compounds produce photographic impressions. C. S.

Relations between the Inactive Gases and the Radioactive Elements. F. H. LORING (*Chem. News*, 1909, 100, 37—39).—It is shown that the inert gases and certain radioactive elements can be arranged in series of four, so that the second differences between the atomic-weight numbers are in inverse geometrical progression.

H. M. D.

A Method of Registering the Length of the Path of α-Rays, and a Peculiarity of the Path. Béla Szilard (*Compt. rend.*, 1909, 149, 271—273).—A zinc sulphide screen, prepared by covering a glass slip with a thin layer of the substance, is placed at a certain angle above a layer of the radioactive material. A photographic plate is placed in direct contact with the glass of the screen, and left exposed for a period which depends on the activity of the material under examination. With this arrangement, the only rays which can act on the plate are the luminous rays generated by the impact of the α-rays on the phosphorescent screen. That part of the screen which is within the range of the α-rays produces an effect on the immediately adjacent parts of the photographic plate, and from an examination of the plate and measurement of the angle of inclination of the screen, the range of the α-particles can be determined.

In the author's experiments, measurements were made with various specimens of polonium, differing very considerably in activity, and the times of exposure varied from three days to four months. The values of the range obtained in the different experiments agree very well, but are all about 2 mm. less than the range obtained by the ionisation method.

H. M. D.

Behaviour of Kunzite under the Influence of Becquerel Radiation. Stefan Meyer (*Physikal. Zeitsch.*, 1909, 10, 483—484).—When subjected to the action of the β- and γ-rays of radium, the violet-red colour of kunzite changes to green. This colour change does not affect the fluorescence which kunzite exhibits under the influence of β-rays. This is also exhibited by a sample of the mineral which has been decolorised by heating. The fluorescent light is polarised in a direction parallel to the long axes of the kunzite fibres.

When kunzite, transformed by the action of β-rays, is placed in the path of a beam from an arc light, the green colour gradually disappears, and, after passing through an intermediate colourless stage, the original violet-red colour is obtained. The transformation is due to the action of the violet and ultra-violet rays. On warming, the fluorescence of the transformed green kunzite commences at a much lower temperature than that of the unchanged mineral. H. M. D.

Influence of the Polarisation of the Exciting Light on the Emission of Electrons at the Surfaces of the Alkali Metals. Julius Elster and Hans Geitel (*Physikal. Zeitsch.*, 1909, 10. 457—465).—Experiments are described which indicate that the photo-electric effect produced by polarised light at the surface of the alkali metals is dependent on the relative positions of the planes of incidence and polarisation. More electrons are liberated by light which is polarised at right-angles to the plane of incidence than by light which is parallel polarised. The maximum velocities of the electrons are approximately the same in the two cases. On the other hand, the proportion of the total electrons, which have a velocity smaller than the maximum, is in all cases greater for light which is polarised at right-angles to the plane of incidence of the active light.

H. M. D.

Decomposition of Water by Ultra-violet Rays. Miroslaw Kernbaum (*Compt. rend.*, 1909, **149**, 273—275. Compare this vol., ii, 364).—Fifteen c.c. of freshly boiled distilled water, contained in a quartz vessel, were subjected to the action of the rays from a mercury lamp for a period of 200 hours. By means of an attached manometer, gas was found to be evolved after some time. This appeared to be generated at a constant rate for a considerable period, but afterwards the rate of evolution diminished, and during the last thirty-five hours there was no further increase in the pressure. Examination of the gas showed it to be hydrogen, and hydrogen peroxide was detected in the water. Ultra-violet rays, like the β-rays of radium, decompose water, therefore, according to the equation: $2H_2O = H_2O_2 + H_2$.

H. M. D.

Conductivity and Viscosity in Mixed Solvents Containing Glycerol. M. R. Schmidt and Harry C. Jones (*Amer. Chem. J.*, 1909, **42**, 37—95).—The electrical conductivity of lithium bromide, cobalt chloride, and potassium iodide has been measured in glycerol at 25°, 35°, and 45°, and in mixtures of glycerol with water, methyl alcohol, and ethyl alcohol respectively in dilutions of 10 to 1600 litres; the results are given in tabular form and are also represented by curves. The conductivities in pure glycerol are comparatively low, and do not attain definite maxima in the dilutions used; in all cases the conductivities in the mixed solvents are less than the sum of the conductivities in the individual solvents. The molecular conductivity of cobalt chloride in ethyl alcohol is abnormally low, and it is shown by ebullioscopic measurements that in this solvent the salt is considerably polymerised. The temperature-coefficients of the conductivity of the salts in pure glycerol are abnormally high, being about 10% per degree between 25° and 35°, and more than 8% per degree between 35° and 45°, corresponding with the great diminution in viscosity of these solutions with rise of temperature. In the case of solutions of cobalt chloride in ethyl alcohol, the temperature-coefficient of the conductivity is negative.

The viscosities of the pure solvents, of the mixed solvents, and of $N/10$-solutions of the three salts in mixtures of the solvents in varying proportions have also been determined at 25° and 35°. The temperature-coefficient of the fluidity of glycerol between 25° and 35° is 11·53% per degree, which is nearly equal to the temperature-coefficients of conductivity of the salts. The fluidities of the solutions are usually less than those of the corresponding solvents, but the fluidity of $N/10$-solutions of potassium iodide in water, and in 25% and 50% glycerol and water, is greater than that of the solvents themselves. There is a close parallelism between the forms of the conductivity and fluidity curves; in no case is the law of averages obeyed. As a dissociating solvent, glycerol resembles water more than it does the alcohols.

The paper contains a summary of the previous results of Jones and his co-workers on this subject. G. S.

[Potential Measurements.] Jean Billitzer (*Zeitsch physikal. Chem.*, 1909, 67, 201—202).—Palmaer's criticisms (Abstr., 1907, ii, 424) of the author's experimental results are not justified, as the more important experiments have now been repeated by Freundlich and Mäkelt (this vol., ii, 368), and the author's results confirmed.

G. S.

Chemical Action and Ionisation. G. Reboul (*Compt. rend.*, 1909, 149, 110—113. Compare Broglie and Brizard, this vol., ii, 535).—According to the electronic theory of matter, chemical changes which disturb the internal equilibrium of the molecules might cause a liberation of ions from the atoms. An apparatus is described by which chemical operations were carried out on one plate of a charged condenser maintained in a suitably evacuated vessel, and the leak due to ionisation was measured by the electrometer.

Interactions unaccompanied by effervescence, such as the neutralisation of bases by acids, produce no ionisation, even when much heat is disengaged. Interactions accompanied by effervescence, such as the action of acids on metals, give rise to both positive and negative ionisation, the former usually predominating. Actions in which the gas between the condenser plates participates, such as the action of carbon dioxide on fused potash or the oxidation of metallic sodium, give rise to ionisation so long as the attack is superficial, but quickly disappearing when the action penetrates below the surface. Charges of both sign are produced with a preponderance of negative. Gaseous interactions may give rise to great conductivity, such as in the interaction of ammonia and hydrogen chloride, or a small conductivity, as when ammonia and fumes of nitric acid interact.

The conclusion is drawn that in every medium where molecular disturbance occurs, electric conductivity is found. Proof is lacking, however, that the effects described are due to electrons apart from material particles.

Note by A. Gautier (*ibid.*, 113).—In the Solfatare at Naples the steaming exhalations which arise everywhere on a hot day are visibly intensified by the kindling of a flame at one point. This phenomenon is attributable to the condensing effect of ions produced by the flame. R. J. C.

Theory of Volatilisation by Atomic Rays. Johannes Stark (*Zeitsch. Elektrochem.*, 1909, 15, 509—512). Franz Fischer (*ibid.*, 512—514).—With reference to Kohlschutter's latest publication on the cathodic volatilisation of metals (this vol., ii, 639), Stark gives an approximately quantitative development of his theory of the phenomena (Abstr., 1908, ii, 1007). The kinetic energy imparted to an atom of mass, m_1, carrying a positive charge, e, in passing through a cathode fall of potential, K volts, is $\frac{1}{2}m_1v_1^2 = eK/300$. When an atom moving with this velocity collides with a metallic atom on the surface of the cathode moving at a comparatively low velocity, and assuming elastic impact, the velocity of the metallic atom (of mass m_2) after impact is $v_2 = 2\sqrt{m_1}/m_2 \times \sqrt{2eK/300}$. The volatilisation should thus increase, other things being equal, with the molecular weight of the gas. The volume of the atoms of the gas is also of importance, because a small atom has a greater chance of penetrating below the surface layer of the cathode before collision, and only collisions at the surface are likely to result in the escape of an atom of metal from the cathode. This may be why the volatilisation in hydrogen soon becomes independent of the cathode fall. The existence of a limiting value of the cathode fall below which volatilisation does not occur is regarded as of great interest, because if the atoms of metals are held together by electrical forces, a certain definite increase of the energy of an atom would be needed to overcome these forces and allow of the escape of an atom.

Both Stark and Fischer criticise Kohlschütter's views in tho sense that the ratios of the quantities of different metals volatilised under similar circumstances approximate so very roughly to multiple proportions that they cannot be regarded as proving the formation of chemical compounds between the metals and the gases. T. E.

Influence of Pressure on the Electrolytic Conductivity of Solutions. Friedrich Körber (*Zeitsch. physikal. Chem.*, 1909, 67, 212—248. Compare Tammann, Abstr., 1899, ii, 137).—The apparatus and method of measuring the influence of pressure on the electrical conductivity of solutions have already been described by Tammann. Observations were made on a number of solutions up to pressures of 3000 kilos. per sq. cm.

With increase of pressure the electrical conductivity increases, but the magnitude of the effect diminishes with increase of temperature. The isotherms of the change of resistance with change of pressure for dilute solutions of potassium chloride show minima at all temperatures up to 100°. The effect of pressure on the ionic friction and on the viscosity of the solvent corresponds for aqueous solutions of sodium chloride, but this behaviour is not general, and does not hold for solutions of potassium chloride. It is shown by a comparison of the results for dilute solutions of a number of potassium and sodium salts that the influence of pressure on the ionic friction for strong electrolytes is the sum of the effects on the individual ions.

Ions with small atomic weight usually show a larger diminution of frictional resistance with pressure than those with high atomic weight, but potassium and sodium ions form an exception to this rule. With increase of temperature, the isothermals representing the influence of pressure on the ionic friction for different electrolytes tend to approach each other, but it is shown from the results of experiments with hydrochloric acid that hydrogen ions form an exception to this rule.

Up to the highest pressures employed, the direction of the influence of pressure on the conductivity of strong electrolytes is independent of the concentration up to moderate concentrations; the magnitude of the effect becomes smaller as the concentration increases. For solutions of greater dilution than 1 mol. in 100 litres, the influence of pressure on the conductivity of the solvent water becomes of importance, and an expression is given which represents this effect in dilute solutions with considerable accuracy.

The curves obtained by plotting the influence of pressure on the conductivity for solutions of zinc sulphate as ordinates against the concentrations as abscissæ show distinct maxima at a concentration of about 0·4 normal solution at 20° for all pressures.

The effect of pressure on the degree of dissociation of acetic acid at 20°, obtained by an indirect method, agrees with that calculated by Planck's formula, but with increase of temperature the influence of pressure on the dissociation increases, whereas according to Planck it should diminish. G. S.

Technique of Electric Transport and Dialysis Experiments with Organic Colloids. Filippo Bottazzi (*Atti R. Accad. Lincei*, 1909, [v], **18**, i, 485—489).—A description of apparatus employed in these measurements. T. H. P.

Electric Charge of Textile Substances Immersed in Water or in Electrolytic Solutions. J. Larguier des Bancels (*Compt. rend.*, 1909, **149**, 316—319).—Cotton, wool, and silk, etc., have in distilled water a negative charge, and this increases in alkaline solutions. The charge diminishes in presence of acids, and may even become positive. The negative charge (in distilled water or an alkaline liquid) diminishes under the influence of positive ions (Ba, Cu, Zn), and increases in presence of positive ions (sulphate, ferrocyanide). The employment of tannin or potassium dichromate does not involve any appreciable modification in the charge which the textiles take in water. In dyeing, the charge may, in some cases, be modified. The charge of wool dyed with methylene-blue diminishes considerably, owing, perhaps, in part, to the free ions contained in solutions of the dye. N. H. J. M.

The Sun as a Source of Heat for Chemical Experiments. Alfred Stock and Hans Heynemann (*Ber.*, 1909, **42**, 2863—2866).—By focussing the sun's rays on some crystalline silicon contained in an evacuated glass vessel, the crystals were fused in a few seconds, showing that a temperature of 1450° had been attained; copper and cast iron were fused almost instantaneously. A thermo-electric couple heated in the same way registered a temperature of 1030°, whereas on allowing the air to enter the vessel the temperature did not exceed 675°. It is hoped to extend this investigation, using improved lenses or concave mirrors. P. H.

An Approximate Determination of the Boiling Point of Metals. Harold C. Greenwood (*Proc. Roy. Soc.*, 1909, **82**, *A*, 396—408).—The metals were heated in a carbon tube resistance furnace, the temperature being measured by an optical pyrometer directed on the lower part of the crucible through a side-tube. The boiling point was measured by observing the temperature at which visible ebullition took place, the surface of the metal being watched through an absorbing glass A current of hydrogen through the furnace facilitated ebullition by diffusing into the crucible and removing the heavy vapour. Carbon tubes were used as crucibles, except in the case of metals which combine with carbon, which were heated in graphite crucibles brasqued with pure magnesia. The results obtained, which may require some correction when the temperature scale has been more accurately fixed, indicate the following boiling points: aluminium, 1800°; antimony, 1440°; bismuth, 1420°; chromium, 2200°; copper, 2310°; iron, 2450°; lead, 1525°; magnesium, 1120°; manganese, 1900°; silver, 1955°; tin, 2270°. C. H. D.

Determination of Molecular Weights by the Ebullioscopic Method. RICHARD MEYER and KURT DESAMARI (*Ber.*, 1909, **42**, 2809—2814).—In the determination of molecular weights of sparingly soluble substances in benzene or other solvents by the ebullioscopic method, it is imperative that a correction be applied for changes of atmospheric pressure. From Young's measurements the b. p. of benzene changes 0·0427° per 1 mm. between 70 and 90°, so that a change of only 0·5 mm. in the atmospheric pressure during the determination may affect the value of the molecular weight to the extent of 50—80%. The best plan is to note any change of atmospheric pressure on an aneroid barometer, reading directly to 0·1 mm., and apply a correction to the b. p. of benzene calculated from the above data. Numerous experiments are quoted, in which very different molecular weights of one and the same substance are obtained; by applying the correction, the values become concordant and approximate to the theoretical value. C. S.

Vacuum Distillation Apparatus with an Electrically Heated Discharge Contrivance for Solid Substances with High or Low Melting Points. JULIUS BREDT and A. VAN DER MAAREN-JANSEN (*Annalen*, 1909, **367**, 354—358).—The apparatus described is an improvement on that devised by Haehn (Abstr., 1906, ii, 841), in that there is no "dead-space" between the heating arrangement and the distillation flask. The exit-tube of the distillation flask is heated by means of an electric current which is caused to flow through a nickel wire about 1·75 metres long and 0·2 mm. diameter, wound spirally on a glass rod, the whole being enclosed in a sealed glass tube which passes down the centre of the exit-tube. It is possible by this device to heat the exit-tube throughout its whole length to 300°, and substances such as colophony, phenanthraquinone, and sulphur may be distilled under reduced pressure without danger of the exit-tube becoming choked during the process. A figure of the apparatus is given in the original, which should be consulted for details as to the means of measuring and regulating the temperature of the exit-tube, etc. W. H. G.

Law of Constant Dissociation Pressures. HENRY LE CHATELIER (*Compt. rend.*, 1909, **149**, 250—254).—The author points out that the trustworthy experimental data which can be cited as evidence of the constancy of the dissociation pressure in the dissociation of solids giving rise to a single gaseous product of dissociation are very limited in number. On the other hand, many observations would appear to indicate that this pressure is a fraction of the extent of the dissociation. These apparent discrepancies from the requirements of the phase rule are supposed to be due to the action of surface forces in the finely divided solid product of dissociation.

To prevent the interference of surface energy in measurements of dissociation pressure, the addition of a small quantity of a solvent, in which both the solid substances are measurably soluble, is recommended. In these circumstances the equilibrium pressure is quickly set up, and the variability conditioned by the fineness of subdivision of the solids is eliminated. H. M. D.

Method of Analysis by Miscibility Curves; Application to Edible Oils. Émile Louïse (*Compt. rend.*, 1909, 149, 284—286). —The temperatures have been determined at which acetone when mixed with certain oils gives rise to a homogeneous liquid. When these are plotted as ordinates, and the relative proportions of oil and acetone as abscissæ, curves are obtained which enable different oils to be easily distinguished from one another. The differences between the curves are made the basis of a method of examining oils. According to this, increasing quantities of the oil are added to 20 c.c. of acetone, and the temperature at which miscibility is attained is determined after each addition. The oil and the acetone must be carefully dried before use, and the latter should be standardised by determining the miscibility for petroleum distilling at 210—225°. From curves contained in the paper, it is evident that the miscibility determinations show very large differences for olive oil, on the one hand, and cotton seed and sesame oil on the other. H. M. D.

Rôle of the Solvent in Chemical Kinetics. Hans von Halban (*Zeitsch. physikal. Chem.*, 1909, 67, 129—182).—The rate of decomposition of triethylsulphine bromide into diethyl sulphide and ethyl bromide has been investigated in a number of organic solvents at different temperatures. As regards their effect on the rate of the reaction, solvents can be divided into two classes: (1) those containing hydroxyl groups, such as the alcohols and acetic acid, in which the velocity is small: (2) other solvents, such as acetone and chloroform, in which the velocity is much greater. The variation of velocity within the groups is comparatively small. The reaction in acetone is greatly retarded by the addition of water, but the latter has much less effect on the reaction in acetic acid. The temperature-coefficient of the reaction is high, the quotient for 10° being sometimes as much as 6 at low temperatures, but it varies greatly with the solvent. In the great majority of cases, the variation of the velocity with temperature is satisfactorily represented by the well known Arrhenius formula.

The rate of formation and rate of decomposition of *p*-bromophenyldimethylallylammonium bromide in a number of organic solvents have also been investigated. In this case, also, the effect of temperature on the rate of decomposition is very great, but the rate of formation of the salt is much less affected by rise of temperature. It is shown by ebullioscopic measurements that, contrary to the statement of Wedekind and Teletoff (Abstr., 1904, i, 37), higher ammonium salts, such as phenylbenzylmethylallylammonium iodide, split up only into two components in boiling chloroform.

The bearing of the above results is discussed at length. There is no general relationship between the rate of reaction and the properties of the solvent, and, as van't Hoff has pointed out, such a relationship is only to be expected when it is possible to separate the purely kinetic influence of the solvent from its effect on the equilibrium. The solubility in a particular solvent of the reacting substances and the substances formed appear to be of great importance in determining the velocity.

The general question of the effect of temperature on the rate of chemical reactions is discussed, the recent work of Trautz and Volkmann (Abstr., 1908, ii, 824) being adversely criticised in some respects. The temperature-coefficient of unimolecular reactions appears in general to be higher than that of polymolecular reactions.

G. S.

Formation of Esters. ANTON KAILAN (*Zeitsch. Elektrochem.*, 1909, **15**, 500—505. Compare this vol., ii, 129, 305).—Polemical.

T. E.

Proposed Solution of the Equation of Condition for Calculating Atomic Weights. GUSTAVE D. HINRICHS (*Compt. rend.*, 1909, **149**, 124—125. Compare this vol., ii, 140).—The author objects to the solution of his equation of condition (Abstr., 1907, ii, 945) worked out by Dubrueil by the method of least squares (Abstr., 1908, ii, 937). Hinrichs' equation requires an inverse proportionality between x, the deviation of the atomic weight from a round-number value (X), and ΔX, the variation in atomic ratio when X is increased by 1/100,000 of its value. Dubrueil's solution of the equation requires a direct proportionality of x to ΔX. A careful study of the one hundred and twenty principal chemical actions used to determine atomic weights lends no support to Dubrueil's thesis. R. J. C.

New Proof of the Existence of Molecules. III. THE SVEDBERG (*Zeitsch. physikal. Chem.*, 1909, **67**, 249—256. Compare this vol., ii, 277, 561).—In connexion with the previous observations, it is now shown that the depth of colour of a colloidal solution of gold is increased by warming and by the addition of electrolytes; $Na^{\cdot}$ ions have much less effect than $Ba^{\cdot\cdot}$ ions. In this case, also, increase in absorptive power corresponds with an increase in the size of the particles.

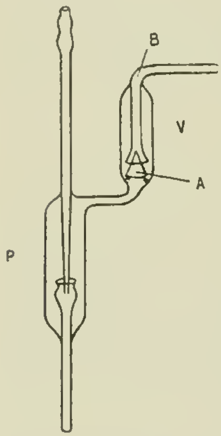
A solution of colloidal gold containing extremely fine particles has been prepared both in the presence and absence of gelatin as protective colloid, and it has been found that under equivalent conditions the depth of colour is less when gelatin is present, a result ascribed to the effect of gelatin in hindering the coagulation of the particles. This view is further supported by the observation that the time taken to obtain the same depth of colour is approximately proportional to the amount of gelatin added. G. S.

Improved Form of Safety Valve. H. STOLTZENBERG (*Chem. Zeit.*, 1909, **33**, 779. Compare Abstr., 1908, ii, 828).—The safety valve previously described (*loc. cit.*), being made in one piece, was difficult to clean, especially the internal ground-glass joint; this has been overcome by having the outside jacket made in two pieces, which are held together and kept air-tight by a stout, wide elastic band. This improvement allows of the valve being taken completely to pieces for cleaning purposes, and does not detract from its efficiency.

J. V. E.

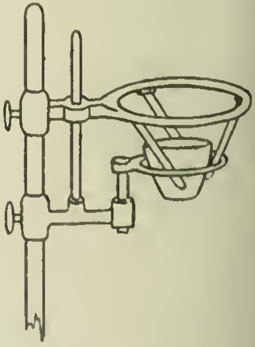
New Safety Valve for Water Pumps. C. GERHARDT (*Zeitsch. anal. Chem.*, 1909, 48, 460—462).—To prevent any variation in the water-pressure causing a backward flow of water, an automatic cut-off valve, indicated by *V* in the accompanying figure, is inserted between the pump and the vessel to be exhausted. *A* is a conical rubber washer, which fits closely into the enlarged end of tube *B* so as to close it completely when the pressure in the vessel being exhausted is less than in the pump *P*.

J. V. E.



Automatic Regulator for the Pneumatic Agitation of Liquids. H. DENÈVE (*Bull. Soc. chim. Belg.*, 1909, 23, 315—318).—Müller has devised a method of agitating liquids, depending on the alternate efflux and influx of air in wide tubes, the lower ends of which are immersed in the liquids. The author has modified Müller's apparatus in replacing the mercury pneumatic interrupter by an electro-magnetic one. In the latter, a wide tube, the lower end of which is immersed in a beaker of mercury, carries two electrodes of different lengths, neither reaching the mercury level, and is connected with the vacuum pump (the action of which raises the liquids to be agitated in the wide tubes). As this tube becomes evacuated, the mercury rises, and when it covers both electrodes, a current passes through the coils of an electro-magnet, which, by depressing a lever, opens the pump to the atmosphere and at the same time completes another circuit which maintains the current round the electro-magnet until the mercury has fallen below both electrodes. This arrangement permits the agitated liquids to attain their original level before evacuation re-commences.

E. H.



Adjustible Crucible Support. CARL BORMANN (*Zeitsch. anal. Chem.*, 1909, 48, 462).—The arrangement described consists of two rings, the upper one being somewhat larger than the lower, and from it three short porcelain rods are suspended. By raising the lower ring, the porcelain rods are brought together, and form a convenient support for a crucible. As will be seen from the figure on p. 724, by raising or lowering the smaller ring this support may be made suitable for almost any size crucible. J. V. E.

Inorganic Chemistry.

System Hydrogen Chloride and Water. FRANK F. RUPERT (*J. Amer. Chem. Soc.*, 1909, **31**, 851—866).—The properties of aqueous solutions of hydrogen chloride, the vapour pressure of which does not exceed one atmosphere, have already been fully studied. Pickering (*Ber.*, 1893, **26**, 277) has determined the f. p. of solutions containing from 0 to 48·8% of hydrogen chloride, and has shown the existence of two solid hydrates, namely, the dihydrate, m. p. −17·7°, and the trihydrate, m. p. −24·4°. The present investigation was primarily undertaken with the object of obtaining a solid monohydrate.

Solutions of a composition approximating to that of the monohydrate have a vapour pressure which is much greater than one atmosphere. The experiments, therefore, had to be carried out under pressure, and this was effected by the use of sealed tubes. The method adopted is described in detail.

Determinations of the densities of liquid and gaseous hydrogen chloride gave the following results. Density of the liquid (grams per c.c.): at 51°, 0·572; at 50°, 0·597; at 45°, 0·658; at 40°, 0·707; at 35°, 0·749; at 30°, 0·783; at 20°, 0·839; at 0°, 0·929; at −15°, 0·984; at −30°, 1·032; at −50°, 1·090. Density of the vapour (grams per c.c.): at 51°, 0·278; at 50°, 0·247; at 45°, 0·215; at 40°, 0·181; at 35°, 0·152; at 30°, 0·130; at 20°, 0·0974; at 0°, 0·0539; at −15°, 0·0543; at −30°, 0·0238; at −50°, 0·0125. The densities of solutions and of their vapours have also been determined up to the saturation point at −15°, 0°, 20°, and 35°.

The composition-temperature curve for the system hydrogen chloride and water has been constructed for all conditions in which the liquid and a solid, or two liquid phases, appear, the portion from 0 to 50% of hydrogen chloride being taken from Pickering's paper (*loc. cit.*). A eutectic point occurs at 57% hydrogen chloride and −23·5°, where the system is monohydrate–dihydrate–solution–vapour, and a maximum f. p. is found at about 66·9% and −15·35°. Near this point two liquid phases are formed, the new phase containing more than 99·9% of hydrogen chloride giving a quadruple point for the system monohydrate–solution–solution–vapour. The solubility of the hydrogen chloride phase in the water phase decreases as the temperature increases, whilst that of the latter in the former increases under these conditions. This relation continues up to 54·5°, the critical point of the hydrogen chloride phase. The portion of the curve showing the equilibrium between the monohydrate and the liquid hydrogen chloride phase was not investigated, owing to the difficulty of measuring such small quantities of water.

The monohydrate, the existence of which was confirmed by analysis, forms white crystals, has D 1·48, f. p. −15·35°, is very soluble in water, but only slightly so in hydrogen chloride, and has a vapour pressure at its m. p. which is approximately equal to that of pure hydrogen chloride, namely, 17·3 atmospheres. E. G.

Isomorphism between Tellurium and Sulphur. Giovanni Pellini (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 701—706).—The course of the solidification curve for mixtures of tellurium and sulphur indicates that these two elements do not unite to form compounds. T. H. P.

Solid Hydrates of Ammonia. Frank F. Rupert (*J. Amer. Chem. Soc.*, 1909, 31, 866—868).—Although the monohydrate of ammonia, or ammonium hydroxide, is regarded as a compound, owing to the similarity of the properties of its solutions to those of the alkali hydroxides, the substance has not hitherto been obtained in the solid state. An investigation of the ammonia hydrates has therefore been carried out.

The f. p.'s of solutions of ammonia containing from 4·1% to 100% have been determined, and the results plotted as a curve which shows maximum f. p.'s at about 49%, f. p. −79°, and at 65%, f. p. −79°. The monohydrate theoretically contains 48·59% of ammonia, and the hydrate, $2NH_3,H_2O$, 65·40%. Eutectic points probably occur at 32% at about −115°, 57·5% at −86·5°, and 78·5% at −96°.

Ammonia monohydrate forms small, colourless crystals, whilst those of the hydrate, $2NH_3,H_2O$, are much larger, transparent, and needle-shaped. Solutions containing from 25 to 60% of ammonia are very viscous below −60°, whilst at −100° the 33% solution can hardly be stirred. E. G.

Allotropic States of Phosphorus. Pierre Jolibois (*Compt. rend.*, 1909, 149, 287—289).—When ordinary red phosphorus is heated in exhausted tubes at temperatures above 360°, its density increases from 2·18 to 2·37, and a new form, termed pyromorphic phosphorus, is obtained. The velocity of the transformation increases with the temperature, and although very slow at 360°, it can be observed even at 250° if iodine, which acts as a catalyst, is added in very small quantity. On examination of specimens of red phosphorus which had been partly transformed into the pyromorphic variety, it was found that these are always homogeneous, as if a solid solution had been formed.

Red phosphorus melts when heated to 725°; the liquid has a violet colour and D 2·27. When the molten phosphorus is rapidly cooled, it is not transformed into yellow phosphorus, as has been stated by Chapman (Trans., 1899, 75, 734). H. M. D.

Preparation and Properties of Solid Hydrogen Phosphide, $P_{12}H_6$. Alfred Stock, Willy Böttcher, and Walter Lenger (*Ber.*, 1909, 42, 2839—2847).—The method of preparation depends on the observation that spontaneously inflammable hydrogen phosphide, P_2H_4, on coming into contact with granulated calcium chloride is converted into the solid phosphide, $P_{12}H_6$, and phosphine. A yield of 8 grams of the solid from 1 kg. of calcium phosphide can be obtained as follows. A conical filtering flask, three-quarters filled with water, is immersed in a slanting position, with the side-tube pointing upwards, in a warm water-bath at 60°. The side-tube is connected to a short reflux condenser, the far end of which passes into the lower end of the first of a series of three wide glass tubes filled with granular calcium chloride; the third tube is attached to a wash-bottle containing hydrochloric acid, the other end of the wash-bottle being connected to the draught of a fume cupboard. After displacing the air in the apparatus by carbon dioxide, small lumps of calcium phosphide, 1 cm. thick, are introduced into the water in the filtering flask through a wide glass tube passing through the cork in the neck. The formation of appreciable quantities of solid phosphide in the wash-bottle is an indication that the efficiency of the calcium chloride is exhausted; a current of carbon dioxide is then again passed through the apparatus, and the calcium chloride with the solid phosphide is gradually added to dilute hydrochloric acid, cooled to 0°, and thoroughly shaken until all the calcium chloride has dissolved; rise of temperature and exposure to sunlight must be avoided. The solid phosphide in then repeatedly washed with ice-cold water, then with alcohol and dry ether, and finally filtered by the aid of a pump and dried in a vacuum over sulphuric acid and phosphoric oxide. The purity of the substance can only be ascertained by analysis, which is performed by measuring the hydrogen evolved when a known weight of the hydride is distilled over a heated copper spiral in a vacuous tube.

The freshly prepared substance is an odourless, canary-yellow, amorphous powder, which is neutral to litmus; after short exposure to the air, it acquires an acid reaction and an odour of phosphine. If kept in the dark, it is stable, but exposure for a few days to sunlight causes it to turn red and evolve a quantity of spontaneously inflammable gas. If heated suddenly to 200° it catches fire. The only substances in which it is appreciably soluble are liquid hydrogen phosphide and molten phosphorus; its specific gravity in a mixture of chloroform and bromoform was found to be 1·83 at 19°; its physiological action is due to the phosphine produced by its decomposition. P. H.

A New Solid Hydrogen Phosphide, P_9H_2. Alfred Stock, Willy Böttcher, and Walter Lenger (*Ber.*, 1909, 42, 2847—2853).—When the solid hydrogen phosphide, $P_{12}H_6$, is heated in a vacuum it evolves phosphine and turns orange-red; the phosphine so formed is quite pure, and the method is therefore a convenient one for the preparation of the pure gas. The red substance which remains is a new compound of the formula P_9H_2, produced according to the equation: $5P_{12}H_6 = 6P_9H_2 + 6PH_3$.

The substance forms either a flocculent powder or a vesicular mass, according as the temperature is raised slowly or rapidly during the decomposition of the compound $P_{12}H_6$; it is stable in dry air, but in moist air it rapidly increases in weight, acquires an acid reaction, and becomes converted into phosphine and phosphoric acid; it is darkened by contact with alkalis in the cold, and, on warming, dissolves with evolution of phosphine, but it dissolves readily in dry liquefied ammonia without the formation of phosphine. Prolonged heating in a high vacuum at 340—360° converts it into red phosphorus.

P. H.

Action of Liquefied Ammonia on the Two Solid Hydrides of Phosphorus. Alfred Stock, Willy Böttcher, and Walter Lenger (*Ber.*, 1909, 42, 2853—2863).—The compound $P_{12}H_6$ dissolves readily in liquid ammonia to form a clear red solution, which, on keeping, changes its colour to a light yellowish-red; on evaporating off the ammonia, a quantity of phosphine escapes and a black solid remains; the same substance is also obtained by dissolving the hydride P_9H_2 in liquid ammonia and evaporating the solution, but in this case no phosphine is formed, and it is therefore concluded that the substance is not produced directly from $P_{12}H_6$, but from P_9H_2, produced by the decomposition of the $P_{12}H_6$. The black solid is of the nature of a salt, formed by ammonia with the compound P_9H_2, which has acid properties; its ammonia content varies between values corresponding to the two formulæ: P_9H_2,NH_3 and $2P_9H_2,NH_3$. The hydride P_9H_2 may be recovered from its ammonia compounds by warming them or by treatment with acids. P. H.

Volatilisation of Boric Acid by Heating in a Current of the Vapours of Carbon Tetrachloride and Methyl Alcohol. Paul Jannasch and Henry F. Harwood (*J. pr. Chem.*, 1909, [ii], 80, 134).—Boric anhydride is completely volatilised in one hour at a moderate red heat in a current of the vapours of carbon tetrachloride (4 vols.) and methyl alcohol (1 vol.), without any deposition of carbon on the boat or combustion tube (this vol., ii, 759). C. S.

Separation of Argon from Nitrogen. José R. Carracido (*Anal. Fis. Quim.*, 1909, 7, 109—111).—The gas evolved from the mineral water of Urberuaga de Ubilla consists of 97% of nitrogen and 3% of carbon dioxide. This nitrogen is remarkable, inasmuch as it contains no argon; it probably, therefore, was not formed within the earth from atmospheric air. Moissan has stated that in order to absorb nitrogen by means of a mixture of quicklime and magnesium, it is necessary to pass the gas several times over the heated material; this may be true of nitrogen containing argon, but with nitrogen free from the latter gas absorption is instantaneous and complete.

W. A. D.

Tellurides. Charles Austin Tibbals, jun. (*J. Amer. Chem. Soc.*, 1909, 31, 902—913).—This investigation has been carried out with the object of studying the composition and reactions of the tellurides. A review is given of previous work on the subject.

Sodium and potassium tellurides have been prepared by the direct union of the elements, whilst the tellurides of several of the heavy metals have been obtained by double decomposition between sodium telluride and metallic salts in aqueous solution. The alkali tellurides are immediately decomposed on exposure to the air with liberation of tellurium, and, for this reason, all experiments with their solutions have been carried out in an atmosphere free from oxygen. Sodium telluride, Na_2Te, forms colourless crystals containing a large amount of water of crystallisation. Tellurium dissolves in a solution of this salt with formation of the *polytelluride*, Na_4Te_3. Potassium telluride, K_2Te, was obtained as a dark purple solid, which is very soluble in water and is precipitated in small crystals on the addition of alcohol to a strong solution. The following salts are also described: zinc telluride, $ZnTe,H_2O$; cadmium telluride, CdTe, nickel tellurides, $Ni_2Te_3,4H_2O$ and NiTe; cobalt tellurides, $Co_2Te_3,4H_2O$ and CoTe; lead tellurides, $Pb_2Te_3,4H_2O$ and PbTe; silver telluride, Ag_2Te, and copper tellurides, CuTe and Cu_2Te_3. On adding sodium telluride to an aqueous solution of arsenious oxide, an arsenic telluride is precipitated, which is soluble in a solution of sodium polytelluride. Mercuric telluride is precipitated from mercuric chloride solution, but reacts rapidly with excess of mercuric chloride with formation of mercurous and tellurium chlorides. When sodium telluride is added to solutions of auric and platinic chlorides, gold and platinum respectively are precipitated and tellurium tetrachloride is produced. Sodium telluride reacts with ammonium molybdate to form dark coloured solutions which appear to contain telluro-salts. E. G.

Nature of Change which Crystals of Sodium Sulphate Heptahydrate Undergo in Contact with Crystals of the Decahydrate. Désiré Gernez (*Compt. rend.*, 1909, 149, 77—84).—A 66% solution of sodium sulphate cooled below 8° in absence of dust deposits crystals of heptahydrate, $Na_2SO_4,7H_2O$, and the mother liquor remains supersaturated with respect to the decahydrate, $Na_2SO_4,10H_2O$. On sowing the mother liquor with a crystal of the decahydrate, progressive crystallisation occurs until the solid heptahydrate is reached, and then an opacity spreads through the hitherto transparent crystals of $Na_2SO_4,7H_2O$. The porcelain-like mass contains the decahydrate, since a fragment of it induces the crystallisation of $Na_2SO_4,10H_2O$ from its supersaturated solutions; it is, therefore, not merely an allotropic modification of $Na_2SO_4,7H_2O$. On the other hand, van't Hoff's suggestion that the solid heptahydrate has been transformed thus: $10Na_2SO_4,7H_2O = 7Na_2SO_4,10H_2O + 3Na_2SO_4$, is unsupported by experimental evidence. The mass contains more water than the pure heptahydrate, and must therefore hold occluded mother liquor, the crystallisation of which as decahydrate would account for the rise in temperature observed. The author suggests that decahydrate crystallising in interstices between the crystals of heptahydrate gives rise to opacity. A solution was permitted to crystallise in a U-tube with a constricted bottom, and the heptahydrate crystals were rammed down into the constricted part until they completely blocked the tube so that the mother liquor could not be drawn through by the pump. On sowing the mother liquor in one arm of the tube, crystals of the decahydrate grew down at a measurable rate, passed through the heptahydrate as an opacity at the same rate, and finally grew up into the mother liquor in the other arm of the tube.

The author shows that the hydrates of sodium chromate,

$$Na_2CrO_4,10H_2O$$

and $Na_2CrO_4,4H_2O$, sodium acetate, $NaOAc,3H_2O$ and $1\frac{1}{2}H_2O$, calcium nitrate, $Ca(NO_3)_2,4H_2O$ and $3H_2O$, sodium thiosulphate,

$$Na_2S_2O_3,5H_2O$$

and $2H_2O$, exhibit the same phenomenon as sodium sulphate, the lower hydrate in each case being rendered opaque by the subsequent crystallisation of the higher hydrate in its interstices. In all these cases, however, the higher hydrate can be melted by heating to a suitable temperature, and the lower hydrate appears in its original quantity and transparency. With sodium sulphate itself the hypothesis cannot be directly tested, because the heptahydrate is dehydrated on warming. It is shown, however, that transparent crystals of the decahydrate formed at −10° to −12° are rendered opaque by the subsequent crystallisation of the mother liquor (ice) in their interstices, and on warming slightly above 0°, the decahydrate crystals re-appear in the transparent condition. A dilute solution of sodium sulphate, on cooling, often deposits a mass of ice, and the mother liquor then solidifies in contact with a crystal of decahydrate. The decahydrate extends as an opacity through the mass of ice, which may often be melted away, leaving a deposit of small crystals of decahydrate.

R. J. C.

Normal Carbonates of Rubidium and Cæsium. ROBERT DE FORCRAND (*Compt. rend.*, 1909, **149**, 97—100. Compare Abstr., 1908, ii, 256).

—The heats of dissolution at 15° of potassium, rubidium, and cæsium carbonates are +6·38 Cal., +8·75 Cal., and 11·84 Cal. respectively. Saturated solutions at 20° contain 51·61 K_2CO_3, 69·01 Rb_2CO_3, 72·34 Cs_2CO_3 per 100 parts by weight of solution, so that saturated solutions have the composition $K_2CO_3,7{\cdot}20H_2O$; $Rb_2CO_3,5{\cdot}76H_2O$; $Cs_2CO_3,7{\cdot}59H_2O$. The rubidium salt appears to have an abnormal affinity for water. Heat is developed on diluting the saturated solution of rubidium carbonate only. When left in the desiccator, the saturated solutions deposit bulky crystals of hydrates, supposed to be $2K_2CO_3,3H_2O$, $2Rb_2CO_3,3H_2O$, and $2Cs_2CO_3,7H_2O$, although analysis always revealed rather more water. When heated on the water-bath in dry air, potassium and cæsium carbonates are slowly but completely dehydrated, whereas the trihydrate, $2Rb_2CO_3,3H_2O$ is converted into the monohydrate, Rb_2CO_3,H_2O, which is stable until the temperature is raised to 110—120°. Since the heats of addition of the last molecule of water to the hydrates $2K_2CO_3,3H_2O$, $2Rb_2CO_3,3H_2O$, and $2Cs_2CO_3,7H_2O$ are practically equal (4·5 Cal.), these three salts have the same tendency to effloresce, whereas the monohydrate, Rb_2CO_3,H_2O, with heat of formation 7 Cal., is more stable. The anhydrous carbonates of rubidium and cæsium are more powerful dehydrating agents than potassium carbonate.

R. J. C.

Crystallisation of Ammonium Chloride. STEFAN KREUTZ (*Bull. Acad. Sci. Cracow*, 1909, 564—609).—Experiments were made on the growth of crystals of ammonium chloride from pure solutions, and from solutions containing cadmium chloride and various other substances. The presence of small amounts of cadmium chloride has a marked influence on the development of the crystals, these being rhombohedral in habit, owing to hindering of the growth in the direction of the cubic axes. L. J. S.

Colloidal Silver Solutions obtained by the Action of Pure Distilled Water on Silver. MARGHERITA TRAUBE-MENGARINI and ALBERTO SCALA (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 542—545).—When heated for a long time with distilled water, silver dissolves to a slight extent, giving a solution exhibiting all the characters of colloidal solutions. Platinum is also attacked under these conditions, but to a less extent than silver. T. H. P.

Variations in the Structure of Silver Coinage Alloys during Working. ERNESTO PANNAIN (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 523—525).—The author has studied metallographically the various changes in structure produced by the different processes employed in the manufacture of silver coins containing 83·29% of silver and 165·3% of copper. The most characteristic change is that wrought by lamination, which determines elongation of the crystals into the form of parallel fibres. Re-heating tends to give to the structure a regular aspect, whilst the compression produced by actual coining breaks the crystals and gives rise to a structure quite distinct from that of the fused alloy before mechanical treatment. False coinage may hence be detected by examining it metallographically.
T. H. P.

Bolognian Stones. LUDWIG VANINO and E. ZUMBUSCH (*J. pr. Chem.*, 1909, [ii], 80, 69—86).—Of the three methods of preparing the phosphorescent sulphides of calcium, strontium, and barium, it is known that the heating of the sulphates with carbon yields sulphide only, and the ignition of the thiosulphates gives a mixture of sulphide and polysulphide. It is now found that the heating of the oxides with sulphur at 1200° yields sulphides containing polysulphide, but no thiosulphate or free sulphur. The polysulphide plays an important part in producing luminescence, for a Bolognian stone prepared by igniting 13·5 grams of calcium sulphide (obtained from the sulphate and carbon, and therefore free from polysulphide), 0·3 gram of potassium sulphate, 0·3 gram of sodium sulphate, 0·7 gram of lithium carbonate, 0·7 gram of starch, and 0·7 c.c. of a solution of 0·8 gram of bismuth nitrate in 100 c.c. of alcohol, is found to be free from polysulphide and scarcely luminous, whereas a similar stone containing calcium sulphide produced from the oxide and sulphur is extremely luminous. The presence of a large sulphur content is not of great moment; just a slight amount of sulphur, present as polysulphide, is essential for the production of a good stone. Good strontium and barium stones are made by using the thiosulphates.

With regard to the metals, copper, lead, bismuth, thorium, and thallium, which are known to influence the colour and intensity of the luminescence, it is astonishing how little is necessary. A mixture of 40 grams of lime, 6 grams of sulphur, 1 gram of potassium sulphate, 1 gram of sodium sulphate, 0·5 gram of lithium carbonate, and 2 grams of starch, is treated with 1, 2, 3, 4, 5, and 6 c.c. of 0·8% alcoholic bismuth nitrate, and heated for one hour at 1200°; the resulting stones are activated by burning magnesium for fifteen seconds. The most luminous stone is that corresponding with 2 c.c. of bismuth nitrate solution, and contains therefore 0 000135 gram of bismuth per 1 gram of stone.

Sodium sulphate (m. p. 880°) and lithium carbonate (m. p. 660°) have a greater effect than potassium sulphate (m. p. 1074°) in increasing the luminescence. It appears that salts of low m. p. are more efficient than those of high m. p.; too much of any one salt, however, is disadvantageous, a stone containing 2% of lithium carbonate being very luminous, whereas the same stone containing 12% of lithium carbonate was very much less so.

It has long been known that the luminosity of Bolognian stones increases with the temperature. The authors find that an extraordinary increase of intensity is produced when a stone, previously exposed to light, is covered with hot water, benzene, amyl alcohol, glycerol, acids, anhydrides, bases, and salt solutions; even unexposed calcium and strontium stones become luminous by this treatment. Hot sulphuric acid, in particular, produces magnificent effects, causing calcium stones to emit blue rays, strontium stones green rays, and barium stones orange-yellow rays, and also rise of temperature and evolution of hydrogen sulphide. Even cold acids cause an increased luminosity in exposed stones. When stones are treated with water and a reagent such as phosphoric oxide, quicklime, or anhydrous calcium chloride, which develops heat in contact with water, an increased luminosity is observed. Stones which have been prepared in the dark and never exposed to light do not become luminous by treatment with concentrated acids or by warming.

The paper concludes with a detailed account of the compositions of stones which give good blue, yellow, and red luminosities respectively.

C. S.

Action of Soluble Substances on Insoluble Substances. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 295—297, 333—335. Compare this vol., ii, 668).—A solution of sodium chloride (2 mols.) in diffused daylight acts on finely powdered chalk (1 mol.), giving appreciable quantities of calcium chloride after two months, on tricalcium phosphate (1 mol.), giving a trace of the same salt, and on magnesium carbonate (½ mol.), giving an appreciable quantity of magnesium chloride. A solution of uranyl sulphate (large excess) in diffused daylight acts on tricalcium phosphate and on chalk, giving, after two months, notable amounts of calcium sulphate, and on magnesium carbonate, forming magnesium sulphate in one month. An appreciable amount of tricalcium phosphate is converted into chloride by heating on a water-bath at 95° daily for five hours during six weeks, whilst the carbonate is similarly affected by lithium chloride solution.

Appreciable amounts of silver carbonate, chalk, magnesium carbonate, and barium and strontium carbonates are converted into the nitrate by boiling with concentrated sodium nitrate solution for respectively eleven minutes, thirty minutes, 2·5 hours, forty-five minutes, and thirty-five minutes. Under similar conditions, cobalt carbonate is only very slightly attacked after five hours, whilst basic lead carbonate remains unaltered. E. H.

The Microscopic Structure of Portland Cement. ERNST STERN (*Zeitsch. anorg. Chem.*, 1909, 63, 160—167. Compare Abstr., 1908, ii, 589).—In the study of the action of water on Portland cement, the powdered cement has been mixed with water on a microscope slide, and kept in a moist chamber in a current of hydrogen. The formation of a colloidal substance, which often unites to form fibrous connexions between the cement particles, is observed. Slender needles of calcium silicate and aluminate, and of calcium hydroxide, form within the colloid.

The colloidal constituent may be dyed by means of 0·1—0·2% solutions of eosin dyes. Recently set cement dyes very rapidly, cement which has set for a year only very slowly. Alite and belite are not attacked. The process does not appear to be one of true dyeing, but rather of surface adsorption.

The disintegration of mixtures containing dicalcium silicate, $2CaO,SiO_2$ (Day and Shepherd, Abstr., 1906, ii, 770), may be avoided by a very rapid cooling. Of the ternary lime-silica-alumina series, those mixtures disintegrate in which the primary crystals separating on cooling are those of dicalcium silicate. Within the cement region, the primary crystallisation is of mixed crystals of silicate and aluminate, separated from the former region by a eutectic line. The eutectic structure is well developed in the photo-micrographs.

C. H. D.

Double Sulphates. BARRE (*Compt. rend.*, 1909, 149, 292—295).—Strontium sulphate combines with potassium and ammonium sulphates to form the double sulphates, $K_2SO_4,SrSO_4$ and

$$(NH_4)_2SO_4,SrSO_4.$$

The composition of the saturated solution in equilibrium with strontium sulphate and the double salt has been determined for a series of temperatures up to 100°. At 50° the solutions contain respectively 1·92 parts of potassium sulphate and 78·54 parts of ammonium sulphate per 100 parts of water. The ammonium double sulphate is therefore only stable in contact with nearly saturated solutions of ammonium sulphate.

Double sulphates of the same type are also formed by combination of lead sulphate with potassium and ammonium sulphates. The composition of the solutions saturated with respect to lead sulphate and the double salt has been ascertained at different temperatures. At 50° these solutions contain respectively 1·11 parts of potassium sulphate and 19·25 parts of ammonium sulphate for 100 parts of water. H. M. D.

Reactions of Some Salts. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 664).—No interaction has occurred between zinc carbonate and sodium chloride solution or between manganese carbonate and sodium nitrate solution after a further month's contact (compare this vol., ii, 668). A slight reaction has, however, been detected between sodium chloride and cadmium carbonate. The latter is thus distinguished from zinc carbonate. E. H.

Lead Chromate. William Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 665).—If a small quantity of lead chromate is boiled for one-half to one hour with a very concentrated solution of pure potassium nitrate and immediately filtered, the filtrate exhibits a well-marked red fluorescence and contains lead chromate. If, however, the filtrate after some moments is re-filtered, the filter retains the lead chromate, and the second filtrate is absolutely colourless. Sodium nitrate behaves similarly, but much more slowly. The conclusion is drawn that the lead chromate is rendered colloidal, but that the colloidal form re-polymerises very rapidly. E. H.

Purification of Mercury. Joel H. Hildebrand (*J. Amer. Chem. Soc.*, 1909, 31, 933—935).—A modification of L. Meyer's method (*Zeitsch. anal. Chem.*, 1863, 2, 241) for the purification of mercury, in which the mercury is allowed to fall in a fine stream through a long column of mercurous nitrate solution, is described.

The impure mercury is placed in a separating funnel, the delivery tube of which is slightly contracted at 0·5 cm. from the lower end. A piece of closely woven muslin is bound with twine over this end. The mercurous nitrate solution is contained in a glass tube, 1·5 metres long and 2 cm. in diameter, terminating at the lower end in a narrow delivery tube which is bent up to a height of 25 cm. The muslin-covered end of the delivery tube of the separating funnel should dip below the surface of the mercurous nitrate solution, so that the surface tension of the mercury may be diminished and the fine streams running through the muslin break up into very minute globules.

Experiments are described which show that mercury can be readily purified in this way to a degree of purity comparable with that of distilled mercury. E. G.

Bromates of the Rare Earths. II. Bromates of the Cerium Group and Yttrium. Charles James and W. F. Langelier (*J. Amer. Chem. Soc.*, 1909, 31, 913—917 *).—A method has been described by James (Abstr., 1908, ii, 190, 498) for the separation of the yttrium earths which depends on the fractional crystallisation of the bromates.

In the present paper, an account is given of the preparation and properties of these bromates. They are usually prepared either by dissolving the oxide of the metal in bromic acid or, preferably, by the double decomposition of the sulphate of the metal and barium bromate.

Lanthanum bromate, $La_2(BrO_3)_6,18H_2O$, m. p. 37·5°, is soluble to the extent of 416 parts in 100 parts of water at 25°. *Cerous bromate*,

* and *Chem. News*, 1909, 100, 85—86.

$Ce_2(BrO_3)_6,18H_2O$, m. p. 49°, decomposes just above its m. p.; it readily undergoes decomposition in aqueous solution, and this property can be made use of for purifying the element. *Praseodymium bromate*, $Pr_2(BrO_3)_6,18H_2O$, m. p. about 56·5°, is soluble to the extent of 190 parts in 100 parts of water at 25°. *Neodymium bromate*, $Nd_2(BrO_3)_6,18H_2O$, m. p. about 66·7°, is soluble to the extent of 146 parts in 100 parts of water at 25°. Since the praseodymium salt is more soluble than that of neodymium, the latter can be obtained in the least soluble portion and a separation thus effected.

Samarium bromate, $Sm_2(BrO_3)_6,18H_2O$, m. p. 75°, is soluble to the extent of 114 parts in 100 parts of water at 25°. *Yttrium bromate*, $Y_2(BrO_3)_6,18H_2O$, m. p. 74°, is soluble to the extent of 168 parts in 100 parts of water.

All these salts crystallise in hexagonal prisms. When the normal hydrates of lanthanum, praseodymium, neodymium, and samarium bromates are heated at 100°, they are converted into lower hydrates containing $4H_2O$. The anhydrous salts are obtained by heating to 150°, with the exception of praseodymium bromate, which cannot be heated about 130° without decomposition. E. G.

Extraction of Lutecium from Gadolinite Earths. Georges Urbain, François Bourion, and Maillard (*Compt. rend.*, 1909, **149**, 127—129. Compare Abstr., 1907, ii, 956).—Crude yttrium earths of atomic weight 118, separated commercially from earths of the cerium group, were roughly fractionated as chromates to remove most of the yttrium. Fractional crystallisation of the hydrated nitrates from nitric acid gave a mother liquor containing mainly neoytterbium, lutecium, lanthanum, and cerium. Sufficient magnesium nitrate and bismuth magnesium nitrate were added to obtain on cooling a copious crystallisation of double nitrates of bismuth with magnesium, cerium, and lanthanum, the last two double nitrates being insoluble in saturated bismuth magnesium nitrate solution. Bismuth and magnesium were completely removed from the mother liquor, and the earths containing lutecium were precipitated by oxalic acid. The precipitate was converted into nitrate and fractionally crystallised to remove traces of erbium and yttrium and to separate the neoytterbium from the lutecium, which after 100 crystallisations was concentrated in the mother liquor. The lutecium earths, which were very feebly paramagnetic, were converted into chlorides by sulphur monochloride (compare Bourion, this vol., ii, 229). A certain amount of thorium and scandium chlorides sublimed in the process, and the lutecium chloride was heated in a stream of chlorine until it began to sublime also. Fractional sublimation of the chlorides appears to be a possible method of separating neoytterbium from lutecium. R. J. C.

Action of Hydrogen Chloride on Aluminium. Method of Estimation of Metallic Aluminium. Émile Kohn-Abrest (*Bull. Soc. chim.*, 1909, [iv], 5, 768—775. Compare Nilson and Pettersson, Abstr., 1888, 788; Stockhausen and Gattermann, Abstr., 1893, i, 161; Moissan, Abstr., 1894, ii, 450; Escales, Abstr., 1897, ii, 407).—The observations described were made during the course of an attempt to prepare a chloride of aluminium other than $AlCl_3$. Powdered aluminium is not acted on in two hours by cold dry hydrogen chloride, but is rapidly attacked if previously heated in hydrogen at 300°. Gattermann's observation that when once the action has commenced, it continues without further application of external heat, is confirmed. Aluminium powder is attacked more regularly than are the turnings, and the residue in the former case is voluminous and consists of small, grey tufts, whilst in the latter it is white and compact.

The residue from a quantity of aluminium powder is very hygroscopic, and almost completely soluble in hot dilute hydrochloric acid. It consists of hydrated alumina (Al_2O_3,H_2O), neutral chlorides of foreign metals, traces of iron, and a small amount of insoluble matter (carbon, etc.), the amount of the first being almost identical with that previously estimated in the aluminium powder used. No trace of silicon or silica can be detected in either the residue or the volatilised chloride.

When powdered aluminium contained in a porcelain boat is heated in a current of dry hydrogen chloride at 500—600°, a very small quantity of minute spangles is formed on the glass above the boat after the aluminium chloride has volatilised.

At 1100° the action of hydrogen chloride is very rapid, and the sublimed aluminium chloride is found to contain appreciable quantities of calcium chloride, although calcium has not been detected in the ordinary analysis of the aluminium used. When powdered iron is heated at 300° in hydrogen chloride and hydrogen for twenty minutes, a sublimate of ferric chloride is formed, and a brown, amorphous mixture of ferrous chloride and unattacked iron remains. If the iron is mixed with an equimolecular amount of aluminium powder, the aluminium chloride sublimed is at first quite white, then the heated mass becomes covered with beautiful nacreous spangles, and finally the sublimate becomes yellow. Only 1% of the iron is volatilised, whilst the part of the residue soluble in water contains no aluminium. But when only small quantities of iron are present, as impurities in the aluminium, they are almost wholly volatilised in twenty-five minutes.

In order to estimate the aluminium in a sample of the powder, 0·3 gram contained in a porcelain boat is heated at 300° in a current of hydrogen, then for twenty-five minutes in hydrogen chloride, and cooled for ten minutes in hydrogen.

The residue is weighed, and the chlorine in it determined volumetrically, the amount of hydrated alumina being thence deduced.

E. H.

Hydrates, the Vapour Pressure of which varies continuously with the Composition. Ernst Löwenstein (*Zeitsch. anorg. Chem.*, 1909, 63, 69—139).—Whilst most crystalline hydrates have a vapour pressure which alters abruptly at a definite temperature, it has been shown by Tammann (Abstr., 1898, ii, 208) that the zeolites remain clear during dehydration, no new phase being formed, and their vapour pressure, like that of amorphous substances, varies continuously with the quantity of water present. Wyrouboff has also observed that certain oxalates of the rare earths remain clear during dehydration

(Abstr., 1901, i, 7). These points have been more fully investigated by van Bemmelen's method (Abstr., 1897, ii, 137), the hydrates being kept at 25° over sulphuric acid of different dilutions and known vapour pressure, the loss of weight, and the water-content of the crystals being determined after equilibrium is reached.

The vapour pressure of the zeolites chabasite, desminite, and heulandite varies continuously with the water-content, and this is also true of the substitution products obtained by replacing the calcium by potassium, the crystals always remaining clear. The potassium zeolites contain less water than the calcium compounds, and their vapour-pressure for the same proportion of water is higher. Calcium chloride replaces the potassium by calcium, the products being identical with the original zeolites. Ammonium desminite behaves similarly.

Silicic acids, prepared from different zeolites, olivine, and labradorite by the action of hydrochloric acid at 15°, also give continuous curves, indicating the absence of definite hydrates. Whether the silicic acids thus obtained are identical is uncertain, as the different vapour pressures observed may be due to changes in the colloids. Clays are found to contain water in two forms, one part being given off continuously over sulphuric acid of different concentrations, the other being retained even in presence of the concentrated acid. The examination of a large number of clays leads to their classification in the following groups, most of which correspond with the grouping proposed by Le Chatelier (Abstr., 1887, 785):

I. Plastic fireclay, sedimentary clay, $2SiO_2,Al_2O_3,2H_2O,Aq$.
II. Halloysite, $2SiO_2,Al_2O_3,H_2O,Aq$.
III. Kaolin, $4SiO_2,2Al_2O_3,3H_2O,Aq$.
IV. Collyrite, $SiO_2,Al_2O_3,2H_2O,Aq$.
V. Pyrophyllite, $4SiO_2,Al_2O_3,H_2O$.
VI. Montmorillonite, $4SiO_2,Al_2O_2,H_2O,Aq$.

The presence of anhydrous minerals and zeolites affects the vapour pressure of clays: they may be removed by fractional levigation.

The oxalates of lanthanum, erbium, yttrium, cerium, thorium, and zirconium also yield continuous curves. A basic zirconium oxalate, $Zr(C_2O_4)_2,2Zr(OH)_4,Aq$, forms doubly-refracting pyramids, 2 mm. high, which after dehydration re-absorb water, doubling their size without change of shape, remaining doubly-refracting.

Two double oxalates, $Na_3(NH_4)_3Al_2(C_2O_4)_6,7H_2O$ and
$Na_3(NH_4)_3Fe_2(C_2O_4)_6,7H_2O$,
give continuous curves for the loss of the first $2H_2O$, after which the vapour pressure remains constant until only $1H_2O$ remains: this is only driven off at a high temperature. Similar salts containing only two bases, such as $Na_6Fe_2(C_2O_4)_6,9H_2O$ and $(NH_4)_6Fe_2(C_2O_4)_6,6H_2O$, behave like simple oxalates, the loss of water being discontinuous.

The nitrates of cerium, lanthanum, yttrium, and zirconium, the sulphates of cerium, lanthanum, yttrium, didymium, zirconium, and thorium, and uranyl nitrate form true hydrates, giving discontinuous curves. The following hydrates are new: $Ce(NO_3)_3,4H_2O$; $La(NO_3)_3,4H_2O$; $La(NO_3)_3,H_2O$; $Y(NO_3)_3,5H_2O$; $Zr(NO_3)_4,2H_2O$; $UO_2(NO_3)_2,2H_2O$; $La_2(SO_4)_3,3H_2O$. Cerium and lanthanum nitrates form similar hydrates, that of yttrium is different. Yttrium sulphate, unlike cerium and lanthanum sulphates, does not lose water over sulphuric acid.

Boric acid does not lose water over sulphuric acid.

Continuous curves are given by zinc and copper ferrocyanides and by strychnine sulphate, $(C_{21}H_{22}O_2N_2)_2H_2SO_4,6H_2O$.

The velocity with which equilibrium with the sulphuric acid is reached is greatest for those substances which give continuous curves. It depends on the rate of diffusion within the hydrate, which is greatest in zeolites and clays, and least in definite hydrates. The process of dehydration is reversible, and the crystals remain clear during the process, but silicic acids do not re-absorb the whole of the original proportion of water.

The form of the continuous vapour-pressure curve is different for the crystalline hydrates and for the amorphous substances, d^2p/dc^2 being positive in the former, and negative in the latter case. C. H. D.

Passivity of Iron. P. KRASSA (*Zeitsch. Elektrochem.*, 1909, 15, 490—500. Compare Abstr., 1907, ii, 598).—Iron assumes the active form in solutions of sodium or potassium hydroxide of greater concentration than $4N$ at temperatures below the boiling point of the solution. With weaker solutions higher temperatures are necessary (200°, for example, with $2N$-solutions). When such active iron is used as cathode with a small current density it remains active, an oxide of iron being formed, which partly dissolves and partly adheres to the iron. The adhering layer gradually increases in thickness until, when a certain thickness is attained, the iron becomes passive and oxygen is evolved. The change is a gradual one, the potential (compared with the $N/10$-calomel electrode) changing in boiling $10N$-sodium hydroxide, for example, from $-1\cdot23$ to $+0\cdot27$ volt. If, on the other hand, a large current density is employed, the iron becomes passive at once, and no visible change occurs at its surface. Between these extremes any intermediate condition can be produced by taking a suitable current density and strength of solution. The author, therefore, draws the conclusion that in all cases the passivity is due to a skin of oxide.

The optical evidence against this view brought forward by Müller and Konigsberger (Abstr., 1907, ii, 924) is discussed. The author comes to the conclusion that a layer of oxide of sufficient thickness to produce passivity might not change the reflecting power of the iron by more than 2%, and could, therefore, readily escape observation.

T. E.

Cementation of Iron by Carbon in a Vacuum. LÉON GUILLET and CH. GRIFFITHS (*Compt. rend.*, 1909, 149, 125—127).—Margueritte (1864) and, recently, Roberts-Austen believed that solid iron could absorb pure carbon whereas Caron (1864) disputed the point. Charpy has recently shown that iron can be carbonised by carbon monoxide (this vol., ii, 405). The authors have re-investigated the cementation of iron by pure carbon, special care being taken to exclude gaseous carbon compounds by maintaining a vacuum, and to ensure intimate contact between iron and carbon. Sugar-charcoal heated to 1000° in chlorine was employed. A mixture of carbon and iron was slowly heated to 450—500° in a long porcelain tube glazed inside, and the tube was then connected to a mercury pump. The temperature was raised to 800°, when a small quantity of gas was removed, and then to 1000°, which temperature was maintained during the whole experiment. Preliminary experiments without the vacuum showed that considerable carbonisation of the iron occurred with formation of pearlite. When gas was carefully excluded, no cementation occurred, but if the charcoal had been left in the air to absorb gases, some carbonisation of the iron occurred in spite of the vacuum. The mixture of iron and carbon was also heated in a cylinder pierced with small holes and provided with a screw stopper. If the stopper was left out and the mixture heated in a vacuum, there was no carbonisation, but when the material was rammed down tight by the screw, considerable carbonisation occurred. A sample of thin steel sheet with 0·05% of carbon contained 0·32% after five hours heating under these conditions. The mechanical pressure was sufficient to weld the steel fragments together at 1000°.

The authors conclude that, although when the contact is good carbonisation with pure carbon may occur, it is so slow that under manufacturing conditions direct cementation plays a very unimportant part. R. J. C.

Halogenochromium Salts containing Aluminium, Iron, and Vanadium. Niels Bjerrum and G. Hirschfeldt Hansen (*Zeitsch. anorg. Chem.*, 1909, 63, 151—159. Compare following abstract).—Salts resembling Werner and Huber's dichlorotetra-aquochromium hexa-aquochromium sulphate, the second chromium atom of which is replaced by other metals, have been prepared. They are all very soluble in water, and are precipitated by sulphuric acid in the form of green leaflets with angles approaching 60°. They are not alums, although resembling alums in water-content and composition.

Dibromotetra-aquochromium hexa-aquochromium sulphate,

$$[CrBr_2(H_2O)_4][Cr(H_2O)_6](SO_4)_2,2H_2O,$$

is prepared from violet hexa-aquochromium sulphate and dibromotetra-aquochromium bromide. *Dichlorotetra-aquochromium hexa-aquo-aluminium sulphate* and the corresponding *dibromo*-compound are prepared from aluminium sulphate and the chromium halides. Ferric sulphate does not yield a chloro-compound, but the *dibromo*-compound, $[CrBr_2(H_2O)_4][Fe(H_2O)_6](SO_4)_2,2H_2O$, is readily obtained. Its colour is like that of the aluminium salts, but soon becomes brown. The *dichloro-vanadium* salt is obtained by the electrolytic reduction of vanadyl sulphate and addition of chromium chloride. The product is very stable. The corresponding *dibromo*-compound is prepared in similar manner.

It was not found possible to prepare similar salts containing titanium or tervalent cobalt or manganese.

Bromopenta-aquochromium sulphate, $[CrBr(H_2O)_5]SO_4,H_2O$, described by Werner and Huber (Abstr., 1906, ii, 170) as an analogue of Recoura's salt, is best prepared from dibromochromium bromide and sulphuric acid. C. H. D.

Physico-chemical Investigations of the Chromium Chlorosulphates. NIELS BJERRUM (*Zeitsch. anorg. Chem.*, 1909, 63, 140—150. Compare Abstr., 1906, ii, 363).—The conductivity, velocity of transformation, and colour of the chromium chlorosulphates have been examined, the results confirming the formulæ

$$[CrCl(H_2O)_5]SO_4,H_2O$$

for Recoura's salt, and $[CrCl_2(H_2O)_4][Cr(H_2O)_6](SO_4)_2,2H_2O$ for Werner and Huber's salt.

The conductivity of both salts in 0·01 molar solution increases rapidly at first, then passes through a maximum, and falls asymptotically to a limiting value. The initial conductivity in each case is equal to that calculated from the corresponding chlorides, namely, λ 140 for the chlorochromium sulphate and λ 125 for the dichlorochromium chromium sulphate.

The first transformation, the ionisation of the chlorine, proceeds much faster than the second, the formation of a sulphate complex, and it is therefore possible to calculate the velocity constant of the former from the conductivity observations. The values $k = 0{\cdot}008—0{\cdot}0039$ and 0·0137—0·0065 are found for the velocity constants of the two salts respectively.

The extinction coefficients for a number of rays have been measured for both salts, on the assumption that free and combined ions have the same colour, provided that complexes are not formed. Thus all hexa-aquochromium salts have the same colour in solution, whether dissociated or not. In the solutions examined, the hydrolysis was restrained by addition of acid. The extinction coefficients of Werner and Huber's salt agree within the limits of experimental error with those calculated from the mean of those for the dichlorotetra-aquochromium ion and the hexa-aquochromium ion, whilst Recoura's salt, on the other hand, gives values indicating a different constitution, as required by the hypothesis. C. H. D.

Chromic Acid. GREGOIRE WYROUBOFF (*Bull. Soc. chim.*, 1909, [iv], 5, 765—767. Compare Walden, Abstr., 1888, 1008; Ostwald, Abstr., 1888, 1009; Miolati, Abstr., 1901, ii, 381; Abegg and Cox, Abstr., 1904, ii, 662; Sand and Kaestle, Abstr., 1907, ii, 178; Spitalsky, Abstr., 1907, ii, 338, 695; Lundberg, Abstr., 1907, ii, 967; Sherrill, Abstr., 1908, ii, 92).—When a solution of chromic acid is treated with an equimolecular quantity of calcium, strontium, zinc, copper, cerium, or lanthanum carbonate, effervescence ceases when half the carbonate has been added, whatever the concentration (3—30%) of the acid or the temperature (15—70°) of working, and from analysis of the resulting solution, chromic oxide and the basic oxide are always found present in the ratio $CrO_3 : M''O = 2 : 1$.

The sesquioxides of iron and aluminium behave less definitely. In the cold solution, ratios are found oscillating about the mean $CrO_3 : M_2O_3 = 5{\cdot}2 : 1$, whilst if chromic acid solution is heated, the ratios approximate to 4·8 : 1, instead of the normal 6 : 1. Chromic hydroxide behaves peculiarly, giving insoluble chromium chromates of variable composition, whilst the liquid contains only a small quantity of chromium, depending on the concentration and temperature. The conclusions drawn from these facts are, firstly, that physico-chemical methods are essentially incapable of determining the basicity of an acid, and, secondly, that chromic acid (a very weak acid) does not exist in the free state, but when liberated from its salts condenses to a polychromic acid, which again in the presence of strong bases is depolymerised, as are the polytungstic and polymolybdic acids. From the experiments cited, it seems to exist in solution as a dichromic acid, but in very concentrated solutions it may be much more condensed, since well crystallised compounds of tri- and tetra-chromic acids are known. E. H.

Transformations of Iron and Steel. GRENET (*Bull. Soc. chim.*, 1909, [iv], 5, 758—764).—A theoretical consideration of the mutual solubility of iron and carbon, the transformation of pure iron, and the solution of iron in carbon, from which the conclusions are drawn that the phenomena exhibited by steels belong to the general case of phenomena produced in all alloys the constituents of which can form solid solutions decomposable into their elements at certain temperatures, and that the laws deduced from the study of steels probably apply to all alloys. E. H.

Inorganic Salts of Titanium Peroxide. ARRIGO MAZZUCCHELLI and ENRICO PANTANELLI (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 608—613. Compare this vol., i, 631).—For the preparation of inorganic salts of titanium peroxide, which are very readily soluble and practically uncrystallisable, the author treats with alcohol the solution containing titanium sulphate, hydrogen peroxide, and an alkali sulphate in rather less amount than corresponds with the ratio $TiO_3 : X_2SO_4$.

In this way the following salts have been prepared: $TiO_2(KSO_4)_2,7H_2O$; $TiO_2(NaSO_4)_2,10H_2O$; $TiO_2(NH_4SO_4)_2,xH_2O$; $TiO_2(LiSO_4)_2,7H_2O$; $TiO_2Cl_2,2NaCl,9H_2O$; $TiO_3,P_2O_5,Na_2O,3H_2O$, and $O(TiO_2,P_2O_5,Na_2O)_2,24H_2O$. T. H. P.

Hydrates of Thorium Chloride and Bromide. EDOUARD CHAUVENET (*Compt. rend.*, 1909, 149, 289—292).—When the hydrate, $ThCl_4,8H_2O$, is dried at the ordinary temperature and pressure it yields $ThCl_4,7H_2O$. When heated at 50° in a current of dry hydrogen or hydrogen chloride, $ThCl_4,4H_2O$ is formed, and at 100° the product is $ThCl_4,2H_2O$. Above 100° basic chlorides are formed. The heats of solution of the various hydrates are: $ThCl_4$, +56·7 cal.; $ThCl_4,2H_2O$, 41·08 cal.; $ThCl_4,4H_2O$, 26·23 cal.; $ThCl_4,7H_2O$, 14·7 cal.; $ThCl_4,8H_2O$, 11·45 cal.

When a solution of thorium hydroxide in alcoholic hydrogen bromide is evaporated at 100°, well formed needles of the dodecahydrate, $ThBr_4,12H_2O$, are obtained. When dried at the ordinary temperature and pressure, this yields $ThBr_4,10H_2O$; in an exhausted desiccator, $ThBr_4,7H_2O$ is obtained. The heats of solution of the various hydrates are: $ThBr_4$, +70·19 cal.; $ThBr_4,7H_2O$, 22·55 cal.; $ThBr_4,10H_2O$, 9·84 cal.; $ThBr_4,12H_2O$, 2·30 cal.

A comparison of the two series of observations shows that the oxybromides are formed at lower temperatures than the corresponding basic chlorides. H. M. D.

Thorium Phosphates. A. Colani (*Compt. rend.*, 1909, 149, 207—210. Compare Abstr., 1907, ii, 878).—The analogy between thorium and uranium is well shown by the parallelism existing between their phosphates. Troost's phosphates of thorium closely resemble those of uranium previously described by the author; the series has now been completed by the preparation of new thorium halogen phosphates and of double phosphates containing calcium and strontium. *Thorium chlorophosphate*, $3ThO_2,ThCl_4,2P_2O_5$, prepared by heating thorium chloride with anhydrous thorium metaphosphate in a current of dry carbon dioxide, is a heavy, white, crystalline powder, insoluble in water and acids, but decomposed by boiling sulphuric acid or on fusion with alkali carbonates.

Thorium bromophosphate, $ThBr_4,(3ThO_2,2P_2O_5)_3$, prepared in the same way as uranium chlorophosphate, but employing a very large excess of thorium bromide, occurs as a pearly-white, crystalline powder. This compound is very stable, and resists the action of molten alkali carbonates and of most acids. It was analysed after decomposition with boiling concentrated sulphuric acid. The existence of these halogen-phosphates throws light on the occurrence of fluorine in monazites. The following double phosphates were prepared in the same way as the corresponding uranium compounds. *Thorium calcium phosphate*, ThO_2,CaO,P_2O_5, forms brilliant needles, whilst the analogous *strontium* salt occurs in minute, colourless crystals. A well defined barium salt has not been obtained. W. O. W.

Double Nitrate and Oxalate of Thorium. Ottorino Angelucci (*Atti R. Accad. Lincei*, 1909, [v], 18, i, 526—530. Compare Abstr., 1907, ii, 773).—In view of Ramsay's results on the disintegration of the copper ion into the lithium ion by the action of radium emanation and of the thorium ion into carbon by further resolution of thorium-*C*, the author has studied the properties of solutions of thorium nitrate in order to discover whether the carbon dioxide evolved from these solutions is due to disintegration of thorium-*C*, or to oxidation or to the decomposition of organic acids used in the isolation of the thorium and not completely eliminated in the subsequent purification.

A concentrated solution of thorium nitrate, D 2·25—2·30, placed in a dilatometer, showed, after a fortnight, a considerable increase in volume, indicating that decomposition had taken place. After some months, the solution deposited acicular crystals having a composition corresponding with the formula $6Th(NO_3)_4,Th(C_2O_4)_2,48H_2O$.

The conclusion is hence drawn that the carbon dioxide evolved from solutions of thorium nitrate is formed by decomposition of the oxalate present in the form of a readily soluble complex salt, and is not a result of the degradation of radiothorium or of radioactive phenomena.

T. H. P.

Hydrolytic Decomposition of Bismuth Bromide. René Dubrisay (*Compt. rend.*, 1909, 149, 122—124).—Bismuth bromide solution, free from uncombined bromine, was diluted with variable amounts of water, and, after removing the precipitate, the ratio of bismuth to bromine in the liquid phase was determined. Contrary to the case of bismuth chloride, the extent of the hydrolysis of bismuth bromide is not appreciably altered by temperatures varying from 15° to 95°.

The variation of bismuth with bromine in the liquid phase follows a regular curve, whence the conclusion is drawn that within the limits of dilution studied only a single oxybromide is produced. The ratio of water to bromine in dilute solutions leads to the same result.

R. J. C.

Velocity of Hydrolysis of an Inorganic Salt, Potassium Ruthenium Chloride. S. C. Lind and F. W. Bliss (*J. Amer. Chem. Soc.*, 1909, **31**, 868—885).—The velocity of hydrolyis of inorganic salts has not been much studied, since, in most cases, the hydrolysis is instantaneous, and, in cases in which the rate is measurable, the difficulties of measurement and the many factors influencing the hydrolysis have rendered it impossible to obtain a satisfactory kinetic equation.

Potassium ruthenium chloride, K_2RuCl_5, rapidly undergoes hydrolysis in aqueous solution, the rate of which can be determined by the increase in electrical conductivity due to the hydrochloric acid formed. The solution, which is originally red, gradually becomes black, and when completely hydrolysed has the appearance of a colloid. On addition of alkali hydroxide, ruthenium hydroxide, $Ru(OH)_3$, is immediately precipitated.

The equilibrium of the hydrolysed solution is not altered by dilution, change of temperature, or addition of acid, and hence the conclusion is drawn that the reaction is irreversible and does not reach a homogeneous equilibrium. The hydrolysed product, probably $Ru(OH)_2Cl$, has a positive catalytic influence on the rate, resulting in a period of constant velocity, extending over the first half of the course of the reaction, which has been used with slight corrections to obtain a velocity constant. The rate of the reaction in a solution of the salt in hydrochloric acid (0·1*N*—0·4*N*) is approximately proportional to the concentration of the acid. It is suggested that this is best explained on the supposition that the rate of hydrolysis is determined by the hydroxyl-ion concentration. In aqueous solutions the velocity is at a maximum at the beginning of the reaction, whilst in acid solutions a distinct period of induction is exhibited similar to that observed by Goodwin (Abstr., 1897, ii, 16) in the case of ferric chloride, which is likewise attributed to autocatalysis.

The temperature-coefficients between 22° and 30° are as follows: for 0·005 molar solution, 3·27; for a 0·0025 solution, 2·96; for 0·00125, 2·63; and for 0·0025 molar in 0·01*N*-hydrochloric acid is 5·40. The rate is also increased by dilution; the coefficient of dilution from 0·005 to 0·00125 molar is 2·23 at 22°, 2·17 at 25°, and 1·80 at 30°. The coefficient in a solution in 0·01*N*-hydrochloric acid is 1·08 at 25°, or, in other words, dilution has practically no effect when the acid concentration remains constant. When, however, the concentrations of both salt and acid are diminished from 0·005 molar in 0·04N-hydrochloric acid to 0·00125 molar in 0·01N-hydrochloric acid, the dilution coefficient at 25° is 5·15. From these results, and the fact that the reaction is slower in the more concentrated solutions, the general conclusion is drawn that the accelerating influence of either increase in temperature or dilution has the greater effect on the slower reaction. The acceleration produced by doubling the dilution is about the same as that effected by an increase of 3° in temperature. Sunlight has no influence on the rate of the reaction. Both platinum and platinum-black electrodes have a positive catalytic influence on the rate of hydrolysis, amounting for the latter to 50% in the Ostwald form of cell. E. G.

Mineralogical Chemistry.

Nature and Origin of Gases Forming Volcanic Fumaroles or Issuing from Craters of Ancient Volcanoes. Armand Gautier (*Compt. rend.*, 1909, **149**, 84—91. Compare this vol., ii, 674).—The gases given off by lavas of Vesuvius three and eighteen months after the eruption of 1906 are, in general, those which are obtained by vacuum distillation at red heat of such igneous rocks as basalt or granite. Recent lavas, which are hottest, emit chlorides of sodium, potassium, ammonium, iron, copper, lead, and arsenic, excess of hydrogen chloride, water vapour, and various permanent gases. As the lava cools, the less volatile substances condense in fissures, until finally only gases and very volatile products are emitted. The three months old lavas of Vesuvius were at 300°, and the gases issuing contained 62·5 to 77% of water vapour, which apparently, as in many other instances, could not have originated in rain or the moisture of the soil. Hydrogen chloride, which is very abundant in fresh lava, had almost disappeared. It is suggested that it had been used up in reconverting into chlorides the oxides and oxychlorides formed by the action of water at higher temperatures. Carbonyl sulphide, carbon monoxide, sulphur, and boron compounds had also almost entirely disappeared. The permanent gases from lava contain 12 to 17% of oxygen and rather more than four times as much nitrogen by volume. Argon and helium are present in notably greater ratio to the nitrogen than in air. It is remarkable that free hydrogen is found in admixture with oxygen issuing from the hot crater.

The hydrogen is supposed to originate in decomposition of water at great depths, whereas the oxygen is drawn in as air through fissures in the base of the volcano by the up-draught in the central shaft. Carbon dioxide, which was present to the extent of 34%, after three months, but only 3%, after eighteen months, certainly appears to come from the deep-seated reservoir of volcanic activity. The Solfatare of Naples gives water vapour and permanent gases, of which 96 to 97% is carbon dioxide. The gases given off by the hot springs of Agnano also contain at least 96% of carbon dioxide, as well as methane, nitrogen, helium, argon, and neon. R. J. C.

Methods for the Collection and Preservation of Gases from Fumaroles and Volcanic Springs or Soils. ARMAND GAUTIER (*Compt. rend.*, 1909, **149**, 245—250).—Two simple arrangements of apparatus which the author has employed for the collection of volcanic gases are described. In the second arrangement, which is designed for use in the case of gases consisting almost entirely of carbon dioxide, the latter is to a large extent absorbed before the gas is placed in communication with the exhausted collecting tube. By this means the volume of gas which has to be preserved for analysis is enormously reduced. H. M. D.

Manganese and Iron Minerals from the Crystalline Schists of Broșteni, Roumania. VASILE C. BUȚUREANU (*Ann. sci. Univ. Jassy*, 1909, **6**, 7—23. Compare Abstr., 1908, ii, 955).—Further analyses of carbonates and of "brostenite" from other localities are given. The massive, reddish-grey carbonates give the formula $5MnCO_3,FeCO_3$ after deducting variable amounts of admixed rhodonite ($MnSiO_3$). The compact, grey carbonate from Rarău, which is of sedimentary origin, gives, however, the formula $2FeCO_3,MnCO_3$. The several analyses of "brostenite" lead to the formulæ

$$RO,2MnO_2,2H_2O,$$

$RO,3MnO_2,2H_2O$, $RO,3MnO_2,3H_2O$, and $RO,5MnO_2,H_2O$, where R = Mn, Fe, Ca, Mg. Except for the presence of water, these formulæ correspond with those of various manganites which have been prepared artificially. L. J. S.

Hopeite. GIUSEPPE CESÀRO (*Bull. Acad. roy. Belg.*, 1909, 567—593).—The paper consists mainly of a criticism of a communication by Spencer (Abstr., 1908, ii, 397) on the same mineral.

For the index of refraction of hopeite the author obtains the value 1·6, and points out that Des Cloizeaux's value, 1·471, is that of the oil used. The mineral has the axial angle 83°13′, and the birefringences $n_m - n_p$ 9·3, $n_g - n_m$ 2·2, and $n_g - n_p$ 11·5, whilst the respective constants obtained by Buttgenbach for the Broken Hill hopeite are 51°42′, 9·7, 0·8, and 10·5.

The minerals from the two sources also have a different optical appearance in convergent polarised light.

Parahopeite forms anorthic crystals (optically positive) having D 3·31. Tarbuttite is orthorhombic ($a:b:c = 0·95832 : 1 : 1·32037$), optically negative, has an axial angle of 90° (approx.), index of refraction β 1·7, and D 4·12. E. H.

Natural Ferrous Sulphate. JUAN CALAFAT Y LEÓN (*Anal. Fis. Quim.*, 1909, **7**, 214—216).—In the neighbourhood of the station of Fuente Santa (Almeria) large masses of crystalline ferrous sulphate exist. The mineral is found in veins between slaty rocks, and is associated with alum and other substances, such as ferric oxide. The

neighbourhood is situated geologically at the transition from Triassic to Cambrian; the Triassic rocks are limestones and dolomites, and the Cambrian rocks, ferruginous clays and slate. Gypsum, alum, and other sulphates also occur abundantly in the neighbourhood, the sulphates probably having been formed from prior existing carbonates.
W. A. D.

Alterations in the Oxygen in Sea-water Collected in the Dark. Hans Winterstein (*Biochem. Zeitsch*, 1909, 19, 425—433).—The gases of sea-water depend not only on physical conditions, but on the presence of living organisms, and the effect of those which specially contain chlorophyll. According to Pütter, water collected in the dark, for instance, from the depths of the ocean, shows on exposure to light an increase of oxygen at the expense of carbon dioxide. This was not confirmed in the present research. Any change which does occur in the light results in a loss of oxygen. W. D. H.

Physiological Chemistry.

Blood Gases of Invertebrate Marine Animals. Hans Winterstein (*Biochem. Zeitsch.*, 1909, 19, 384—424).—The animals specially investigated were those which contain respiratory pigments in their blood, such as hæmoglobin, hæmocyanin, chlorocruorin, etc. The hæmocyanin-containing blood of *Octopus* contains 4·2 to 5% of oxygen, of *Maja* and *Palinurus* about 1%; the hæmoglobin-containing blood of *Glycera* from 2 to 3%, and of *Cardita* and *Pectunculus*, 1 to 2%; the hæmoerythrin-containing blood of *Sipunculus*, 2%. In invertebrates, when respiratory pigments are absent (*Patella, Pinna, Ascidia*, etc.), the amount of both oxygen and nitrogen depends on purely physical conditions. The differences between venous and arterial blood, except in the *Octopus*, are small. It is regarded as doubtful whether the function of the pigments is wholly or even chiefly respiratory. The amount of carbon dioxide in the blood is extraordinarily small; this probably depends on the low intensity of gaseous metabolism, and on the readiness with which carbon dioxide is excreted. Full analytical details are given. W. D. H.

The Rate of Digestion in Cold blooded Vertebrates. Oscar Riddle (*Amer. J. Physiol.*, 1909, 24, 447—458).—The experiments were performed with fish, frogs, and turtles, and the results indicate that within certain not very wide ranges of temperature, van't Hoff's rule applies to their digestive processes, the average of eight valid coefficients being 2·62. The range of temperature within which the speed of digestion is doubled with a rise of 10° differs in different classes of vertebrates, the range being most restricted in amphibians. Temperatures, however, have an influence quite apart from this, for sometimes low, and sometimes high, temperatures inhibit or destroy ferment activity. W. D. H.

Action of Pancreatic Juice on Esters. L. Morel and Émile Terroine (*Compt. rend.*, 1909, 149, 236—239. Compare this vol., ii, 497).—The action of the pancreatic juice on the esters of aliphatic mono- and di-basic acids has been examined, and it is found that the hydrolytic action is feeble except in the presence of biliary salts. In many cases hydrolysis proceeds in a manner different from that induced by chemical agents; thus, in the series of ethyl esters of saturated fatty acids the speed of hydrolysis increases until it reaches a maximum at ethyl butyrate. The same phenomenon is noticed in the alkyl acetates, the maximum occurring at the butyl term. The presence of an ethylenic linking, or a ketonic or hydroxyl group, diminishes the rate of hydrolysis. *iso*Butyric and methylmalonic esters are only slightly attacked. The author considers that his experiments do not support the theory of the specific action of diastases. W. O. W.

Diastatic Decomposition of α- and β-Methyl-*d*-glucosides. H. Bierry (*Compt. rend.*, 1909, 149, 314—316).—The intestine of dogs contains a ferment, *α-glucosidase*, which decomposes α-methyl-*d*-glucoside. Aqueous macerations of the intestinal mucus have very slight action on β-methyl-*d*-glucoside. The pancreatic juice of dogs and horses is without action on either compound. The gastro-intestinal juice of *Helix pomatia* attacks both the α- and the β-glucoside, but especially the latter.

The results, and those of other investigations, indicate that the field of action of diastases is very limited, and that each diastase attacks only derivatives of the same sugar, or even only α- or β-derivatives. N. H. J. M.

Variation of some Diastases during the Metamorphosis of a Caddis-fly, Limnophilus flavicornis. Xavier Roques (*Compt. rend.*, 1909, 149, 319—321).—The digestive activity in the larva was found to be greatest during the period preceding the formation of the pupa; it diminishes considerably in the young pupæ. The invertine increases until the second half of the life of the pupa, and then remains unchanged. N. H. J. M.

Absorption of Fats Stained with Sudan III. Lafayette B. Mendel (*Amer. J. Physiol.*, 1909, 24, 493—496).—When fat stained with dyes insoluble in water, such as Sudan III, is administered to animals, the pigment readily passes into the lymph and blood stream. Since these pigments are soluble in free fatty acids as well as in neutral fats, their presence in the lymph cannot be taken as evidence either for or against the possibility of the digestion of the fat prior to absorption. The conclusions thus differ from those recently drawn by Whitehead (this vol., ii, 498) from similar experiments. W. D. H.

Cytolysis in Paramœcium. Rosalind Wulzen (*Quart. J. exp. Physiol.*, 1909, 2, 293—301).—The same agents which cause cytolysis in the sea-urchin egg and in red-blood corpuscles produce also cytolysis in *Paramoecium*. As in the other cases, the formation of a membrane is a preliminary essential step in cytolysis. This membrane resists lipoid solvents so greatly that it probably contains but little lipoid. W. D. H.

Lipoids. VI. Sigmund Fränkel (*Biochem. Zeitsch.*, 1909, 19, 254—285).—This research deals with methods of extraction from the brain. The following are the results with human brain; the dry residue amounts to 23%, and of this the following percentages occur in successive extracts:

Acetone extract (cholesterol)	10·96
,, (unknown extractive and phosphatides)	9·64
Light petroleum extract	27·84
Benzene extract	13·53
Alcohol ,,	6·25
Ether ,,	0 91
Residue (protein, etc.)	31·63

In round numbers the dry material consists of two-thirds lipoids and one-third protein. About 48% of the lipoids are unsaturated compounds. W. D. H.

The Interfibrillar Substance of the Dermis. E. H. B. van Lier (*Zeitsch. physiol. Chem.*, 1909, 61, 177—187).—The main constituent of the ground substance of the true skin is a mucoid of very similar nature to that found in other connective tissues, but contains more carbon and nitrogen. This conclusion is opposed to that of Reimer and Körner, who deny the mucoid character of this substance. The name coriin is suggested; among its decomposition products, Levene's glucothionic acid was found, but the exact chemical nature of this material is still unknown. W. D. H.

Hydrolysis of Ox-muscle. Thomas B. Osborne and D. Breese Jones (*Amer. J. Physiol.*, 1909, 24, 437—446).—This is work similar to that previously carried out with other kinds of flesh, the various cleavage products being estimated and compared with those already found. The table shows considerable differences, among other points brought out being the increase in glycine, alanine, valine, leucine, and proline on passing from the lower to the higher forms of life.

W. D. H.

Neutrality of the Tissues and Tissue-fluids. T. Brailsford Robertson (*J. Biol. Chem.*, 1909, 6, 313—320).—It is suggested that the proteins of the plasma and tissues play a part in maintaining their neutrality; and that the liberation of carbon dioxide from the blood in the lungs is accompanied by a transfer of sodium from the carbonic acid to the proteins of the plasma, the reaction proceeding in the reverse direction in the tissues. The amount of sodium bound by protein is probably more than enough to bind the excess of carbon dioxide in venous over that in arterial blood. W. D. H.

Uricolysis. H. GIDEON WELLS and HARVEY J. CORPER (*J. Biol. Chem.*, 1909, 6, 321—336).—The tissues of the human body possess no uricolytic power, such as is found in other mammals; the same is true for human fœtal tissues. The presence of urate deposits in the kidneys of new-born infants cannot therefore be due to the tardy appearance of the uricolytic enzyme. The deposition is probably due to the high proportion of uric acid in the urine of the new-born, and favoured by local kidney conditions. The placenta possesses no uricolytic activity, and the statement that allantoin occurs in the urine of pregnant women and new-born children is doubted. Uricolysis was found in the liver of the guinea-pig, and absent in the organs of the turtle, spleen, bone-marrow leucocytes, and serum of the dog. W. D. H.

Uricase in Animal Tissues. FR. BATTELLI and Mlle. LINA STERN (*Biochem. Zeitsch.*, 1909, 19, 219—253).—The destruction of uric acid by animal tissues is probably a complex process, and the name uricase is given to an enzyme which oxidises it to allantoin, according to the equation: $C_5H_4O_3N_4 + H_2O + O = C_4H_6O_3N_4 + CO_2$. In free oxygen the reaction is most energetic, especially at 50—55°. The enzyme is precipitated with the nucleo-protein. Its amount is estimated by the quantity of carbon dioxide produced. In many tissues, inhibiting substances delay its action, and these can in large measure be removed by alcohol. It is present in most mammalian organs, and is particularly abundant in the liver and kidney. It is, however, entirely absent in man, and also in the duck. W. D. H.

Relation of Ions to Contractile Processes. IV. RALPH S. LILLIE (*Amer. J. Physiol.*, 1909, 24, 459—492).—The present experiments deal with *Arenicola* larvæ. They lose contractility gradually in isotonic solutions of non-electrolytes (dextrose, sucrose), and more rapidly in solutions of magnesium salts. The effect resembles anæsthesia, and contractility is readily restored on return to sea-water, or to various solutions of electrolytes. The action of various electrolytes and ions in this direction is described at length, and this is discussed in connexion with alterations in permeability of plasma membranes. W. D. H.

Allantoin in Normal Urine and its Metabolic Significance. WILHELM WIECHOWSKI (*Biochem. Zeitsch.*, 1909, 19, 368—383).—Although allantoin occurs in the urine of other mammals, it has never yet been identified with certainty in human urine, and the opinion has been held that in man uricolysis does not occur, or at any rate that the destruction of uric acid if it takes place pursues a different course in man from what it does in other mammals. It is now shown that allantoin is present in human urine, and is therefore probably an intermediate stage in uric acid catabolism. Its amount, however, indicates that it is far less than in other mammals.

W. D. H.

Colloids in Urine. I. LICHTWITZ and OTTO ROSENBACH (*Zeitsch. physiol. Chem.*, 1909, **61**, 112—118).—Colloid substances occur in normal human urine and exert a protective influence on gold solution. They can be precipitated by dialysis, by shaking with benzene, or by alcohol. They are not affected by boiling, freezing, or drying, and consist of the protein-precipitating substances and the nitrogenous carbohydrate complex of Salkowski. W. D. H.

Biological Importance of Lecithin. II. W. GLIKIN (*Biochem. Zeitsch.*, 1909, **19**, 270—273. Compare Abstr., 1908, ii, 120).—In degenerative diseases of the central nervous system (dementia paralytica and tabes) the amount of lecithin in the bone-marrow is usually diminished and often altogether absent. The same is true for iron. W. D. H.

Narcosis and Deficiency of Oxygen. I. G. MANSFELD (*Pflüger's Archiv*, 1909, **129**, 69—81).—A discussion of the Meyer-Overton theory of narcosis and the part played by lipoids. Oxygen is much more soluble in fats and lipoids than in aqueous fluids, and the physiological importance of the latter is believed to be the conveyance of oxygen into the interior of the cells, and narcosis is due to interference with this function. W. D. H.

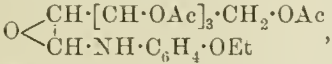
The Degradation of Amino-acids in the Organism under Normal and Pathological Conditions. OTTO NEUBAUER (*Deut. Archiv. klin. Med.*, 1909, **95**, 211—256).—Experiments were made by administering various possible intermediate products between phenylalanine and tyrosine, on the one hand, and homogentisic acid, on the other, to an alcaptonuric patient. The subject of the experiment was kept on a fixed diet, and determinations of the ratio of homogentisic acid to total nitrogen were made. The following substances caused no relative increase in the acid: *p*-hydroxyphenyl-lactic acid, tryptophan, *o*-hydroxyphenylpyruvic anhydride, *p*-hydroxy-β-phenylpropionic acid, *dl*-α-aminophenylacetic acid, acetanilide, *p*- and *m*-hydroxyphenylpyruvic acids, *p*-hydroxyphenyl-lactic acid, phenylethyl alcohol, and *o*-, *p*-, and *m*-hydroxyphenyl-lactic acid. The following substances, on the other hand, caused an increase in the homogentisic acid output: tyrosine, *p*-hydroxyphenylpyruvic acid, quinol-lactic acid, quinol-pyruvic acid, homogentisic acid, and phenyl-lactic acid.

dl-α-Aminophenylacetic acid was administered to a dog, rabbit, and human being. The *l*-acid was excreted unchanged, whilst the *d*-acid underwent deaminisation, giving through phenylglyoxylic acid, by optically active reduction, *l*-mandelic acid. A small portion of both *d*- and *l*-acids was converted into benzoic acid, which was excreted in the conjugated form as hippurate.

From the experiments on normal and alcaptonuric individuals, both by the author and others, the following conclusions were drawn as to the fate of amino-acids in the organism. The amino-acids undergo oxidative deaminisation, yielding keto-acids. The aliphatic keto-acids lose carbon dioxide, and yield fatty acids, which are subject to the known laws of destruction in the organisms. Of the aromatic keto-acids, tyrosine undergoes a corresponding change into a keto-acid, which is oxidised to the corresponding quinol, which later undergoes isomeric change, yielding quinolpyruvic acid; the latter by loss of carbon dioxide yields homogentisic acid, which in the normal individual undergoes further oxidation, yielding finally carbon dioxide and water, but which in the alcaptonuric individual is excreted without further change. Phenylalanine yields *p*-hydroxyphenylpyruvic acid, which is then oxidised as above. The method of tryptophan degradation in the organism is unknown. S. B. S.

Behaviour of Glucosophenetidide and of Tetra-acetylglucosophenetidide in the Animal Organism. St. Mostowski (*Bull. Acad. Sci. Cracow*, 1909, 641—651).—Contrary to statements in the literature, glucosophenetidide does not possess toxic properties. It does not affect the normal temperature of the body, and when administered in milk to dogs whose temperature has been increased by the subcutaneous injection of diphtheritic toxin, it does not produce any marked lowering, passes through the organism unchanged, and can be recovered from the urine.

Tetra-acetylglucosophenetidide,



$$O<\begin{matrix}CH\cdot[CH\cdot OAc]_3\cdot CH_2\cdot OAc\\ | \\ CH\cdot NH\cdot C_6H_4\cdot OEt\end{matrix}$$

, m. p. 132°, prepared from tetra-acetyl-β-bromodextrose and phenetidine (2 mol.) in dry ether, crystallises in white needles. Its antipyretic action in dogs is slow and insignificant, and is probably due to phenetidine produced by partial hydrolysis in the intestines, for about two-fifths of the acetate is recovered from the fæces, scarcely a trace in the urine, and the ratio of free to combined SO_3 is very largely diminished, due probably to combination with the liberated phenetidine. C. S.

Physiological Action of *l*- and *d*-Suprarenine. IV. Emil Abderhalden and Karl Kautzsch (*Zeitsch. physiol. Chem.*, 1909, 61, 119—123).—In mice the subcutaneous administration of *d*-suprarenine confers a considerable amount of imunity towards *l*-suprarenine. The similar power of the latter is not so easy to demonstrate, on account of the smallness of the lethal dose. Further experiments, using larger animals, are in progress. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Influence of Humus on the Development of Yeast and on Alcohol Fermentation. Adam Dzierzbicki (*Bull. Acad. Sci. Cracow.*, 1909, 651—660).—Soil humus has a very favourable effect on the development of yeast and on alcoholic fermentation in solutions containing dextrose, asparagine, and mineral nutrients, especially when small amounts of yeast are employed for inoculation; with large amounts the favourable effect is less marked.

In absence of asparagine, fermentation becomes comparatively feeble, so that the action of humus cannot be attributed to its direct utilisation as food by the yeast, and is probably similar to its effect on the development of *Azotobacter* (Krzemieniewski, this vol., ii, 335).

N. H. J. M.

Paralysing Action of Acids on Alcoholic Fermentation. M. Rosenblatt and Mlle. M. Rozenband (*Compt. rend.*, 1909, 149, 309—312).—The smallest amounts of acids which (*a*) completely inhibited fermentation, and (*b*) the highest amounts without effect were, in gram-mol., as follows:

Acid.	*a.*	*b.*	Acid.	*a.*	*b.*
Dichloroacetic	*M*/100	*M*/2000	Lactic	2*M*	*M*/200
Benzoic	*M*/60	*M*/1000	*iso*Butyric	3*M*	*M*/100
Salicylic	*M*/60	*M*/2000	Propionic	4*M*	*M*/200
Monochloroacetic	*M*/50	*M*/5000	Butyric	5*M*	*M*/200
Trichloroacetic	*M*/25	*M*/4000	Sulphuric	*M*/10	*M*/8000
Nitric	*M*/9	*M*/3000	Oxalic	*M*/10	*M*/1000
*iso*Valeric	*M*/5	*M*/200	Malonic	5·6*M*	*M*/200
Hydrochloric	*M*/5	*M*/3000	Arsenic	2*M*	*M*/500
Formic	*M*/4	*M*/1000	Phosphoric	3*M*	*M*/2000
Benzenesulphonic	*M*/3	*M*/3000	Citric	3*M*	*M*/200
Acetic	*M*/2	*M*/100	Methylarsenic	3*M*	*M*/1000
Ethylsulphuric	2*M*	*M*/4000			

In the case of *p*-hydroxybenzoic, tartaric, boric, and arsenious acids there was appreciable fermentation in saturated solutions; the highest amounts without effect were *M*/60, *M*/200, *M*/4, and *M*/2000 respectively.

N. H. J. M.

Action of Ultra-violet Rays on Fermenting Cider. Maurain and Warcollier (*Compt. rend.*, 1909, 149, 155—157).—The ultraviolet light from a quartz-tube mercury arc is absorbed by passing through 1 mm. of cider to such an extent that two to three minutes' exposure is required to blacken silver citrate paper instead of the few seconds when the cider is replaced by water. With cider diluted to 1 in 20, one minute's exposure is necessary.

A drop of cider 0·24 mm. thick exposed to the rays of the quartz light through 5 mm. of quartz lost its power of fermenting malt extract containing sugar and tartaric acid when the time of exposure exceeded three minutes. An exposure of two minutes or less was not sufficient to kill the yeast. A layer of cider 1 mm. thick whether exposed directly to the lamp at 4 cm. distance or through 5 mm. quartz could not be sterilised in fifteen minutes. Cider diluted to 1 in 20 and exposed in a layer 1·7 mm. thick was sterilised in one to two minutes. Whenever the layer of liquid was so thick that yeast escaped the action of the rays, it is supposed that the ultra-violet light was all absorbed by the first layers of liquid encountered.

R. J. C.

Action of Ultra-violet Rays on Acetic Fermentation in Wine. VICTOR HENRI and JOSEPH SCHNITZLER (*Compt. rend.*, 1909, **149**, 312—314).—The ultra-violet rays above 3021 check the acetic fermentation in wine in presence of air. N. H. J. M.

Chemical Effect of Quartz Mercury Lamp on Water. JULES COURMONT, TH. NOGIER, and A. ROCHAIX (*Compt. rend.*, 1909, **149**, 160—161).—A powerful quartz mercury lamp immersed in clear water destroys ordinary microbes and the coli bacillus to a range of 30 cm. in one minute. After the lamp had been burnt for ten minutes in 1½ litres of water containing 5 c.c. of dissolved oxygen, no trace of ozone could be detected. There was in some waters a slight reduction in the oxidisable organic matters present. Ammonia and nitrites were scarcely affected, nitrates not at all. The bactericidal action of ultra-violet rays is therefore not traceable to chemical changes in the water. R. J. C.

Toxicology of Chlorates. JUAN FAGES VIRGILI (*Anal. Fis. Quim.*, 1909, 7, 104—109 *).—The methods for detecting and estimating small quantities of chlorates described in former papers (this vol., ii, 179, 432, 433) have been utilised in studying the rate of destruction of chlorates in presence of flesh undergoing putrefaction. For this purpose 0·5 gram of potassium chlorate was dissolved in 500 grams of water containing 250 grams of chopped meat, which was then allowed to putrefy. The temperatures varied between −1·8° and 33·8°. The quantity of chlorate present was found to be practically the same as in the beginning during the first ten days. On the tenth day it had fallen to 0·43 gram, on the thirty-first to 0·33 gram, on the forty-fifth to 0·15 gram, and on the sixty-fifth, chlorate could not be detected under the conditions, that is, less than 0·015 gram was present.
W. A. D.

Influence of Radium Radiations on Chlorophyllic and Respiratory Functions of Plants. ALEXANDRE HÉBERT and ANDRÉ KLING (*Compt. rend.*, 1909, **149**, 230—232).—Radium radiations have no appreciable influence on the composition of the atmosphere in which plants are growing. Chlorophyll does not exercise its functions under the influence of the radiation when light is excluded. The cells, however, appear to undergo alteration, since respiration and assimilation are considerably diminished in the case of leaves which have been exposed to the radiation before being placed in daylight. The ratio between respired oxygen and carbon dioxide assimilated is not affected by preliminary exposure to radium. W. O. W.

Retardation of Vegetal Assimilation during Cloudy Weather. ACHILLE MÜNTZ and H. GAUDECHON (*Compt. rend.*, 1909, **149**, 190—191).—By determining the amount of oxygen liberated by the leaves of wheat during respiration, it has been found that the assimilation of carbon takes place about five times more rapidly when the sky is clear than when it is cloudy. W. O. W.

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* and *Ann. Chim. anal.*, 1909, **14**, 289—294.

Elaboration of Phosphorus-containing Material and Saline Substances in the Leaves of Living Plants. Gustave André (*Compt. rend.*, 1909, **149**, 45—48. Compare this vol., ii, 693).—This communication contains the results of monthly analyses of the ash of chestnut leaves and of estimations of total mineral phosphates and of organic phosphorus between May and October. The conclusion is drawn that the soluble phosphates migrate towards the organs of reproduction during the period of fertilisation, and that the amount of lecithin in the leaves reaches a maximum during efflorescence. The amount of silica in the leaves is very small, and remains constant.

W. O. W.

Sodium as a Partial Substitute for Potassium. Burt L. Hartwell and F. R. Pember (21*st Ann. Rep. Agric. Exper. Stat. Rhode Island*, July, 1907, to June, 1908, 243—285. Compare Abstr., 1908, ii, 423).—Experiments with millet and oats showed that the yield was increased by addition of sodium when the amount of potassium present was insufficient for the maximum growth. Rye was less benefited than wheat (*loc. cit.*) and barley by addition of sodium.

In cultures containing too high an amount of magnesium in relation to the calcium, there was a very marked reduction in transpiration and in root growth, whilst the weight of leaf and stem was less affected. Addition of calcium increased the development of roots. Sodium had less effect on root production.

The results indicate that, whilst the principal functions of potassium cannot be performed by any other element, there are other functions which, in some plants at least, may be performed by sodium.

N. H. J. M.

Soluble Carbohydrates and Hemicelluloses in the Seeds of Cicer arietinum. Nicola Castoro (*Gazzetta*, 1909, **39**, i, 608—625).—From the seeds of *Cicer arietinum*, the author has isolated (1) sucrose; (2) lecithin; (3) dextrose or lævulose, or both; (4) a polysaccharide, to which he gives the name γ-galactan, which does not reduce Fehling's solution or form a phenylosazone, but, after hydrolysis by means of dilute mineral acid, strongly reduces Fehling's solution and yields phenyldextrosazone; the $[\alpha]_D^{18}$ of γ-galactan is $+134{\cdot}2°$, the value after hydrolysis being $[\alpha]_D^{17{\cdot}5}$ $+52{\cdot}56°$; when oxidised by means of nitric acid (D 1·15) it gives 37·98% of mucic acid; with hydrochloric acid and resorcinol, it gives Seliwanoff's reaction. The hemicelluloses of the seeds comprise probably a para-galacto-araban and a levulan.

T. H. P.

Unsaponifiable Constituents of Parsley Oil. Hermann Matthes and W. Heintz (*Ber. Deut. pharm. Ges.*, 1909, **19**, 325—328).—Vongerichten and Köhler (this vol., i, 454) have given an account of an investigation of the fatty acids obtained from a solid fat which was separated from the fixed oil of parsley seed. The unsaponifiable matter contained in this fat has now been examined, and the following substances isolated: (1) a saturated hydrocarbon, *petrosilane*, $C_{20}H_{42}$, m. p. 69°, which crystallises in lustrous, white leaflets, and closely resembles the hydrocarbon obtained by Étard (Abstr., 1892, 746) from *Bryonia dioica*; (2) melissyl alcohol; (3) a substance, probably a mixture, which gave the phytosterol reaction, but crystallised in a form resembling that of sitosterol rather than that of phytosterol, and (4) a yellowish-brown liquid.

The fixed oil of parsley seed contains about 14% of unsaponifiable constituents. E. G.

Analytical Chemistry.

Solvents for Use with the Munroe Crucible. Otis D. Swett (*J. Amer. Chem. Soc.*, 1909, **31**, 928—932).—The author gives a list of those precipitates which may be advantageously collected in a Munroe crucible, and also a list of forty-five solvents useful for removing the various precipitates from the felt. The list includes neutral solvents, acids, alkalis, and a large number of saline solutions. L. de K.

Estimation of a Dissolved Substance in Presence of Suspended Material. Warren Rufus Smith (*J. Amer. Chem. Soc.*, 1909, **31**, 935—937).—A definite volume of the clear supernatant liquid is withdrawn, and the amount of material contained is determined (m). The solution is then again made up to the original volume, and, when clear, the operation is repeated (n). The total amount of material (x) in the solution will then be represented by the equation $x = m^2/m - n$. L. de K.

Estimation of Mineral Matters in Vegetable Substances. Henri Pellet (*Bull. Assoc. chim. Sucr. Dist.*, 1909, **26**, 1145—1148).—A reply to Vuaflart (this vol., ii, 182). The author when estimating mineral constituents in such substances as beetroot, wheat, etc., finds that accurate results are obtained by the process of carbonisation and extracting the soluble salts with water. No advantage is obtained by the sulphuric acid combustion method. L. de K.

Analysis of Combustible Gases. Georges De Voldere and Guillaume De Smet (*Bull. Acad. roy. Belg.*, 1909, 622—663. Compare Abstr., 1908, ii, 425).—From a mathematical consideration of the amount of oxygen required for the complete combustion of different gases and the total contraction produced by such combustion, the authors have formulated a series of rules, some of which have been previously discovered by experiment, indicating what mixtures of gases can be analysed by a single complete combustion. These mixtures include (1) a mixture of two known hydrocarbons of one series and one (known) of another; (2) three known hydrocarbons belonging to different series and a known nitrogenous gas (or two of the hydrocarbons may belong to the same series); (3) a mixture of (*a*) ammonia, hydrogen cyanide, and nitrogen, or (*b*) ammonia, hydrogen cyanide, and nitrous oxide, or (*c*) ammonia, nitrous oxide, and nitrogen, or (*d*) hydrogen cyanide, nitrous oxide, and nitrogen, with a known hydrocarbon or oxyhydrocarbon (CH_2O, etc.) other than methane or acetylene with (*a*), ethylene with (*b*), hydrogen or oxygen with (*c*), hydrocarbon containing C_2 with (*d*); (4) a mixture of the four gases nitrogen, ammonia, hydrogen cyanide, and nitrous oxide; (5) a mixture of two known hydrocarbons or oxyhydrocarbons with a known nitrogenous gas; and (6) a mixture of a known hydrocarbon or oxyhydrocarbon with two known nitrogenous gases, except the two mixtures nitrogen, hydrogen cyanide, acetylene (or acetaldehyde) and nitrous oxide, hydrogen cyanide, ethylene (or methyl ether).

By a single complete combustion it is also possible to determine the respective volumes of a group of hydrocarbons and a known hydrocarbon, not belonging to the group, in a mixture containing no other gas.

By a single complete combustion, however, it is not possible (1) to analyse a mixture of hydrocarbons (with which are included hydrogen, oxygen, carbon monoxide, and dioxide) containing more than (*a*) two members of the same series (both known); (*b*) three members of different series (all known); (2) to determine (in a mixture of hydrocarbons) the volume of more than two known series; (3) to analyse a mixture of more than three known hydrocarbons or oxyhydrocarbons, alone or mixed; (4) to analyse a mixture of three known hydrocarbons of the same series with a known nitrogenous gas, or (5) to analyse a mixture of an oxyhydrocarbon with the corresponding hydrocarbon (C_2H_4 "corresponds" with Me_2O, since the latter is separable, thus: C_2H_4,H_2O). E. H.

Estimation of Total Sulphur in Animal Charcoal. ETTORE SELVATICI (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 26, 1164).—About 0·5 gram of the sample is fused as usual with potassium nitrate and sodium carbonate for about fifteen minutes. The mass is boiled with water, and the filtrate is evaporated with excess of hydrochloric acid to separate silica and to remove the nitric acid. The residue is dissolved in water, and to the filtrate is added magnesia mixture (prepared from the chloride) and ammonia, so as to precipitate any phosphoric acid.

The filtrate is then acidified with hydrochloric acid, and the sulphuric acid precipitated with barium chloride as usual.

L. DE K.

Determination of the Free Acid in Electrolytic Copper Baths. MAURICE DEBAISIEUX (*Bull. Soc. chim. Belg.*, 1909, 23, 310—314).—The method proposed by Sims (Abstr., 1907, ii, 574) for the volumetric estimation of sulphuric acid in the presence of copper sulphate suffers the disadvantage of being affected by the concentration of the latter. The author finds that the change from red to yellow of a sulphuric acid solution containing methyl-orange becomes in the presence of copper sulphate a change to bright green. It is shown by titrations of a *N*/2 sulphuric acid solution with *N*/2-sodium hydrogen carbonate solution that the change of the methyl-orange to yellow in the absence of copper sulphate coincides with the change to green in the presence of this salt. The colour of the solution initially varies from rose to violet as the concentration of copper increases, and when this is considerable, the solution during neutralisation becomes colourless or blue before finally turning green. Accordingly, the amount of free sulphuric acid in a copper sulphate solution can be very accurately estimated by titration with sodium hydrogen carbonate solution, using methyl-orange as indicator.

Attempts to estimate the copper in the neutralised solution by titration with sodium hydroxide in the presence of phenolphthalein failed, owing to the precipitation, not of the hydroxide, but of a basic salt. This is corroborated by determination of the change of electrical conductivity of the solution, curves of which are given.

E. H.

Some Modifications of Kjeldahl's Nitrogen Estimation JOHN SEBELIEN, A. BRYNILDSEN, and O. HAAVARDSHOLM (*Chem. Zeit.*, 1909, **33**, 785, 795—796).—The process has been devised for the estimation of nitrogen by Kjeldahl's process in laboratories where electricity, but not gas, is at disposal, and where it is necessary to conduct a large number of analyses simultaneously.

The heating of the substance with sulphuric acid is carried out by means of a specially constructed Heraeus electric furnace. The expulsion of the ammonia formed is carried out by adding excess of alkali and passing at once a current of purified air through the solution; the ammonia is then absorbed in standard acid as usual. The current of air may be kept up for a considerable time, and the "distillation" requires no special attention.

L. DE K.

A Sensitive Reagent for Ammonia. FRIEDRICH TRETZEL (*Pharm. Zeit.*, 1909, **54**, 568).—The reagent is simply an improved Nessler solution. Five grams of mercuric chloride are dissolved in an Erlenmeyer flask in 80 c.c. of water at a gentle heat. Meanwhile, 30 grams of potassium hydroxide are dissolved in 60 c.c. of cold water and put aside. Ten grams of potassium iodide are now dissolved in a 300 c.c. Erlenmeyer flask in 10 c.c. of hot water, and the hot mercuric chloride solution is poured in with constant shaking until the liquid becomes just turbid; on no account should more mercury solution be added. The solution is now filtered, and the potassium hydroxide solution added. After diluting to 200 c.c., another 1 c.c. of the mercuric chloride is added, and the solution is allowed to settle.

L. DE K.

A Rapid Clinical Method for Determining the Ammonia Coefficient of Urines. RAYMOND F. BACON (*Philippine J. Sci.*, 1909, **4**, 153—162).—The ammonia coefficient of a urine, that is, the percentage of the total nitrogen which is present as ammonia or ammonium salts, is of importance in clinical work. The author recommends a simple process for estimating the ratio $NH_3/NH_3 +$ urea, as this ratio is a sufficiently close approximation to the true ammonia coefficient. The method is based on two reactions: (*a*) Millon's reagent, whereby the urea is converted into carbon dioxide and nitrogen, whereas the ammonia is unaffected; (*b*) alkaline solution of hypobromite, when both ammonia and urea yield nitrogen. A special form of apparatus is described. The following formula, in which allowance is made for the fact that the reactions are not quantitative, serves for the calculation of the ammonia coefficient: $A = 100(H - M/2{\cdot}05)/H$, where A is the coefficient, M = number of c.c. of gas from Millon's reagent, and H = number of c.c. of gas from the hypobromite.

The results are only approximate, for example, they vary 10%, but are sufficiently accurate for clinical work, and the determination can be carried out in a very short time. J. J. S.

Volumetric Estimation of Hydroxylamine. ARTHUR STÄHLER (*Ber.*, 1909, **42**, 2695—2696).—An aqueous solution of hydroxylamine hydrochloride is reduced by a strongly acid solution of titanium trichloride or sesquisulphate until the solution has a persistent faint rose coloration. The ammonia is liberated, distilled, and titrated in the usual way. The method is applicable to such organic nitrogen compounds as yield volatile amines on reduction by tervalent titanium. C. S.

Estimation of Small Quantities of Nitrates. L. FARCY (*Bull. Soc. chim.*, 1909, [iv], **5**, 775—779 *).—It has been shown previously that Grandval and Lajoux's method of estimating nitrates is inaccurate in the presence of halide salts (this vol., ii, 344, 615).

MacGowan (Trans., 1891, **59**, 530), making use of the reaction $KNO_3 + 4HCl = NOCl + Cl_2 + KCl + 2H_2O$, discovered by Koninck (Abstr., 1891, 618) based a method of estimating nitrates on the determination of the iodine liberated from potassium iodide by the mixture of chlorine and nitrosyl chloride. On the other hand, Frerichs' method (Abstr., 1903, ii, 328), based on the same reaction, consists in estimating the chlorine in the residue by titration with silver nitrate solution. Utz (Abstr., 1905, ii, 283) and Drawe (Abstr., 1906, ii, 490) find the latter method sufficiently accurate for ordinary purposes, but Müller (Abstr., 1903, ii, 690) states that the results given are too high, and the author finds that the ratio of the nitrate found to that present is about 1·05. Both MacGowan's and Frerichs' methods, however, are more accurate than that of Grandval and Lajoux in the presence of chlorides. The presence of ammonium salts, however, by reacting thus: $NOCl + NH_4Cl = 2HCl + N_2 + H_2O$ with nitrosyl chloride, renders both of the former methods inaccurate, the first by loss of nitrosyl chloride, the second by loss of ammonium chlorides. In fact it is found experimentally that the loss of nitrosyl chloride in MacGowan's method, and that of ammonium chloride in Frerichs' method, correspond almost exactly with those deduced from the above equation.

The conclusions drawn are that MacGowan's and Frerichs' methods are useless in the presence of ammonium salts, although unaffected by chlorides, and that Grandval and Lajoux's method as modified by Perrier and Farcy is preferable in the presence of the former.

E. H.

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* and *Ann. Chim. anal.*, 1909, **14**, 338–342.

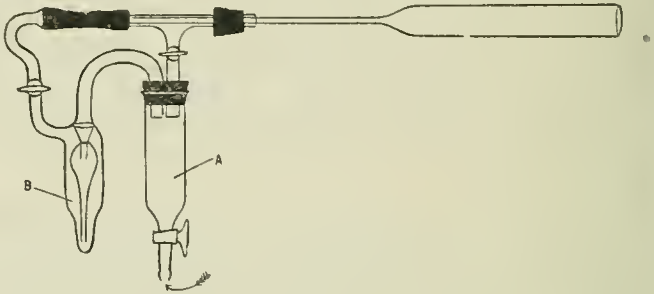
Estimation of Nitric Acid with "Nitron." CARL PAAL and AUGUST GANGHOFER (*Zeitsch. anal. Chem.*, 1909, 48, 545—555).—Experiments are adduced showing the influence of organic substances on the accuracy of the "nitron" process. Dextrin, even if present to the extent of 2%, does not interfere with the complete precipitation of "nitron nitrate" if only enough time is allowed. Peptone interferes to some extent, but its influence may be neutralised by adding a sufficiency of sulphuric acid. It may be removed from the solution by heating with addition of formaldehyde on the water-bath for several hours, and the results of the "nitron" precipitation are then quite satisfactory for practical purposes.

Gelatin, if present to the extent of less than 0·5%, does not interfere. It may be removed from the solution by means of tannin, the excess of which is then precipitated by means of normal lead acetate. The results are fairly accurate. A cold-water extract of meat may be analysed for nitrates after removing the interfering substances by adding normal lead acetate to the boiling solution; if alkaline, some acetic acid should be added. L. DE K.

Volatilisation of Phosphoric Acid and its Quantitative Separation from Phosphates of the Metals of the Ammonium Sulphide Group. PAUL JANNASCH and W. JILKE (*J. pr. Chem.*, 1909, [ii], 80, 113—127).—The separation and the estimation of the phosphorus in the phosphates of iron, chromium, uranium, zinc, nickel, cobalt, and manganese has been accomplished as follows. The phosphate, contained in a silica boat in a combustion tube, the forward end of which is loosely packed with glass-wool, is heated in a current of the vapour of carbon tetrachloride, first at a dull and finally at a bright red heat. The metal, in the form of the chloride, is retained by the glass-wool, whilst the phosphorus, probably in the form of phosphoryl chloride, is collected in a receiver, kept at 90°, and is estimated as magnesium pyrophosphate. It is advisable to mix the phosphate with powdered silica. For some undiscovered reason, the phosphorus in aluminium phosphate cannot be quantitatively separated by this method. C. S.

Estimation of Alkali Phosphates by Direct Titration. M. EMMANUEL POZZI-ESCOT (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 26, 1162—1163).—Ten c.c. of the solution are mixed with two drops of 0·2% solution of helianthin and five drops of 1% phenolphthalein, and dilute sulphuric acid is added until a red coloration appears, which is then removed by cautious addition of dilute alkali solution. The liquid is now titrated with normal or decinormal alkali until a slight rose coloration is visible; 1 c.c. of N-alkali = 0·071 gram of phosphoric anhydride. The process applies to alkali phosphates only. L. DE K.

Improvements in the Apparatus for Elementary Analysis. MAX DENNSTEDT (*Chem. Zeit.*, 1909, 33, 769—770. Compare Abstr., 1908, ii, 321, 984; this vol., ii, 270).—Several improvements in construction of the apparatus for elementary analysis are described, the chief being that indicated in the accompanying sketch, which represents a more convenient and more compact arrangement for supplying a slow current of oxygen to the combustion tube. *A* contains calcium chloride and



B a small quantity of sulphuric acid, which serves to indicate the rate at which the oxygen is passing. Other minor improvements are suggested for which the original must be consulted. J. V. E.

Some Precipitation Reactions with *p*-Sulphobenzeneazodimethylaniline. M. Emmanuel Pozzi-Escot (*Bull. Soc. chim. Belg.*, 1909, 23, 299—303).—The micro-chemical reactions given by *p*-sulphobenzeneazodimethylaniline (helianthin) with a number of metals are described. Mercury gives a slight precipitate of slender needles. Gold is simply reduced. In the cold, copper gives an amorphous, yellow precipitate, which gradually becomes semi-crystalline, especially on warming. Palladium almost immediately gives an abundant precipitate of small, rod-like crystals. Lead gives an amorphous precipitate, which dissolves on warming, and, on cooling, crystallises in very small, hexagonal crystals. Tin readily gives an abundant precipitate of small, square crystals. Silver, especially on warming, forms a felted mass of prismatic crystals. Cadmium salts are precipitated immediately as lozenge-shaped crystals. Zirconium gives a thick, felted mass of slender, prismatic crystals, and also some orange-yellow prisms. The chromium precipitate is a mixture of needles and orange-yellow, prismatic tablets felted together. In the cold, thallium gives a crystalline precipitate of small, rod-like crystals, whilst when heated the product is a conglomeration of prismatic needles. The reaction with uranium is clear and characteristic, the precipitate crystallising readily in large, rectangular, yellow crystals. Cobalt, even in the presence of large quantities of nickel, forms long, violet, prismatic needles grouped in stars and surrounded by smaller needles. Nickel gives an amorphous, green precipitate, which redissolves on warming, and then crystallises in voluminous, yellow, nacreous crystals. Lanthanum is precipitated in amorphous, yellow flocks, soluble on heating, and then crystallising in slender needles. The reaction with manganese is very characteristic, the precipitate being composed of black needles and orange-yellow prisms. Iron and zinc give valueless reactions, small needles in the former, and an amorphous precipitate in the latter case. Erbium also gives an amorphous, yellow precipitate, which is gradually transformed into sheaves of badly defined, prismatic crystals. The precipitate given by glucinum consists of small, highly refracting prisms. With cerium the reaction is very clear and characteristic, a mixture of long, black, prismatic needles and dichroic tablets being produced. Strontium forms large, indefinite, yellow needles. Calcium forms large, golden-yellow needles. Magnesium gives a yellow precipitate, transformed immediately into small, well defined needles, and, on heating, into voluminous, hexagonal tablets. The precipitate with aluminium consists of small, very abundant, violet-black prisms. Didymium gives an amorphous precipitate, becoming crystalline with difficulty on heating. Rubidium forms almost immediately a mass of small, lozenge-shaped crystals. Drawings are given of a number of the crystals described. E. H.

Estimation of the Alkalis in Drinking Waters. Erich Koch (*Zeitsch. angew. Chem.*, 1909, **22**, 1442—1444).—A fully tabulated paper showing that in accurate analysis the indirect methods for the estimation of potassium and sodium in waters are not trustworthy, and that the platinic chloride process should be employed.

L. de K.

Estimation of Alkalis in Silicates. G. Starck (*Zeitsch. anal. Chem.*, 1909, **48**, 415—428).—The silicate is treated according to the old Berzelius method with hydrofluoric and sulphuric acids, and the alkalis are finally weighed as sulphates. Assuming it to be all sodium sulphate, it is dissolved in water so as to yield an approximately $N/0{\cdot}03$ solution, and hydrochloric acid is added so as to obtain a $N/0{\cdot}15$ acidity. The solution is then boiled and precipitated with a calculated amount of barium chloride. When cold, the liquid is diluted to a definite bulk and filtered. An aliquot part of the filtrate is evaporated with excess of platinic chloride. The mass is slightly moistened with water, and left until apparently dry, when the sodium platinichloride, together with the small amount of barium chloride, is removed by means of 80% methyl alcohol. The potassium platinichloride is then collected in an asbestos filter tube, dried at 130°, and weighed. It is advisable to test it for any barium chloride it may still contain, although this is not likely to occur to any extent. L. de K.

Assay of Sodium Sulphide. M. Tschilikin (*Zeitsch. anal. Chem.*, 1909, **48**, 456—458).—Fifteen grams of the sample are dissolved in air-free water, and, after twelve hours, any iron sulphide is collected and the filtrate diluted to 1 litre; 10 c.c. of the solution are added to 50 c.c. of $N/10$-iodine previously diluted with 200 c.c. of water, the liquid is then acidified with 10 c.c. of $N/10$-sulphuric acid, and titrated with $N/10$-thiosulphate; the result = sulphide + thiosulphate.

In order to estimate the thiosulphate alone, 10 c.c. of the solution are added to 5 grams of cadmium carbonate digested with 100 c.c. of water and 10 c.c. of $N/10$-sulphuric acid. After fifteen minutes the solution is filtered, the insoluble matter washed, and the thiosulphate estimated by adding 25 c.c. of $N/10$-iodine, 10 c.c. of $N/10$-sulphuric acid, and then titrating with thiosulphate. As a check on the sulphide estimation, 10 c.c. of the solution may be added to 10 c.c. of a copper sulphate solution (17·3195 grams of crystals in 500 c.c.). After acidifying with *N*/10-hydrochloric acid, the copper sulphide is collected and weighed as such. Thiosulphate is not precipitated. L. DE K.

Detection of Small Quantities of Sodium Carbonate in Waters. J. FLAMAND (*Bull. Soc. chim. Belg.*, 1909, 23, 296—299).—Dilute solutions of the chlorides and sulphates of calcium and magnesium when boiled with hops give a bright green coloration, whilst the carbonates of the same metals give a brownish-rose colour. The alkali carbonates and hydrogen carbonates under the same conditions give a red coloration. The production of the latter is prevented by the addition of gypsum when the amount added is sufficient to react with all the alkali carbonate present. To a solution containing 20 grams of gypsum and 14·71 grams of calcium carbonate per hectolitre, 10 grams of sodium carbonate must be added to give the coloration, whilst in a solution of 4·95 grams of gypsum, 21·42 grams of calcium carbonate, and 3·99 grams of magnesium carbonate per hectolitre, only 1 gram of sodium carbonate is necessary.

Relying on this reaction, quantities of sodium carbonate in natural waters can be detected, which would remain unnoticed in the ordinary methods of analysis.

Seyffert (*Zeitsch. ges. Brauwesen*, 1908) has devised a method of estimating alkali carbonates in water. The amount of combined carbon dioxide is estimated by evaporating the water to half its bulk with a known volume of *N*-sulphuric acid and titrating the excess with standard alkali. To the quantity of sulphuric acid theoretically necessary to transform the chlorides, silicates, and nitrates (previously estimated) into sulphates are added the quantity of sulphuric acid found originally in the water and that required to convert the carbonates into sulphates; from this sum is deducted the amount of sulphuric acid required to convert all the estimated bases present, and the remainder gives the weight of acid combined with alkalis (calculated as Na_2O). Knowing the amount of the latter present as chloride, that combined with carbon dioxide can be deduced, if sodium carbonate has been detected in the manner described. E. H.

Volumetric Estimation of Di-ammonium Hydrogen Phosphate. P. B. DALLIMORE (*Pharm. J.*, 1909, [iv], 29, 69—70).—To the solution is added a definite volume of *N*/10-sodium hydroxide, and the liquid is boiled in order to expel the ammonia. It is then titrated with *N*/10-sulphuric acid, using methyl-orange as indicator. The difference in alkalinity represents half the sodium hydroxide used in the conversion of the di-ammonium salt into the di-sodium compound. Addition of sodium chloride in the titration cannot be recommended.

Many commercial samples are not, however, pure di-ammonium hydrogen phosphate, being deficient in ammonia. L. DE K.

Microchemical Analysis. VI. Alkali Earths Group (Barium, Strontium, Calcium). NICOLAAS SCHOORL (*Zeitsch. anal. Chem.*, 1909, 48, 401—415. Compare this vol., ii, 521).—Barium may be separated from strontium and calcium by means of potassium dichromate. The precipitate on strong ignition yields chromic and barium oxides, from which the latter can then be extracted with dilute acetic acid. From this solution the barium is precipitated with ammonium silicofluoride, and the precipitate, which has a characteristic appearance, is then examined microscopically.

The strontium and calcium are reprecipitated as carbonates by ammonium carbonate, redissolved in nitric acid, and evaporated to dryness. The nitrates are then treated with absolute alcohol, which leaves the strontium undissolved. This is then identified under the microscope after being converted either into chromate or iodate.

Calcium may be tested for even in the presence of barium and strontium by evaporating the acetic acid solution with excess of sulphuric acid. The mass is treated with a little water, which is then evaporated with addition of a little acetic acid. Characteristic crystals of calcium sulphate are thus obtained. L. DE K.

Attempt to Separate the Alkaline Earths in the Electrolytic Way. JACOB S. GOLDBAUM and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1909, **31**, 900—902).—The authors succeeded in estimating with a fair degree of accuracy the metals barium, strontium, and calcium in their mixtures by taking advantage of their different decomposition potential.

The principle of the rotating silver anode and mercury cathode was employed, and the decomposition cell and apparatus were arranged identically in the way described under the separation of alkali metals (Abstr., 1908, ii, 1072). The halogen was also determined by re-weighing the anode. L. DE K.

Separation of Calcium from Magnesium. WALTER C. BLASDALE (*J. Amer. Chem. Soc.*, 1909, **31**, 917—922).—Calcium may be separated from an excess of magnesium by a single precipitation under the following conditions. The solution representing about 0·6 gram of the mixed carbonates and containing 3·5 grams of ammonium chloride is diluted to 300 c.c. and heated to boiling. One gram of oxalic acid is added, and, after five minutes, the liquid is neutralised with 1% ammonia. If very much magnesium is present, the oxalic acid is not added all at once, but at first a little, enough to combine with the calcium; after neutralising the liquid, the remainder is added and the solution again neutralised. After an hour, or not quite so long if there is very much magnesium, the calcium oxalate is collected as usual.

If, however, the magnesium exceeds the calcium by 10 to 1, no satisfactory result can be obtained by a single precipitation.

L. DE K.

Estimation of Clay in Limestone. ANDREA ARCHETTI (*Boll. Chim. Farm.*, 1909, **48**, 409—411).—The ordinary method of estimating clay in limestone, if the latter is rich in magnesium carbonate, yields high results, owing to partial precipitation of the magnesium along with the aluminium. The following procedure avoids such error. Two grams of the powdered limestone are treated with 10%

hydrochloric acid, mixed with one-tenth of its volume of 10% nitric acid, and, when solution is complete, excess of ammonium chloride and slight excess of ammonium hydroxide are added. The precipitate is washed until the washings give no precipitate either with silver nitrate or with sodium phosphate. T. H. P.

Estimation of Lead in the Solder and Plating of Tins used for Tinned Foods. v. Della Crose (*Ann. Chim. anal.*, 1909, **14**, 245—248).—About 0·5 gram of the solder is oxidised with nitric acid, about 5 grams of clean sand are added, and the whole is evaporated to dryness. The lead nitrate is then extracted with water, and to the solution is added an excess of standard dichromate solution. In a portion of the filtrate the dichromate is then estimated as usual by means of ferrous sulphate. If the solder contains iron, it is best to dissolve it in boiling hydrochloric acid, and, after diluting largely with boiling water, to precipitate both lead and tin with hydrogen sulphide. The filtrate is examined for iron, the weight of which is then deducted from the solder taken. The mixed sulphides are then digested with ammonium sulphide, and the undissolved lead sulphide redissolved in hot dilute nitric acid. After neutralising the excess of acid with ammonia, the lead is estimated by means of dichromate as directed. Of plating, 1 gram is scraped off carefully, and then treated in the same manner. If, however, but little lead is present, this may be precipitated from the hydrochloric acid solution by neutralising the free acid and then adding 20 c.c. of dilute sulphuric acid (1 : 20). The lead sulphate is then collected with the usual precautions and weighed. The iron is estimated in the filtrate after removing the tin with hydrogen sulphide. L. de K.

Volumetric Estimation of Lead and of Sulphuric Acid in their Salts. Bernardo Oddo and Antonio Beretta (*Gazzetta*, 1909, **39**, i, 671—675).—In the titration of lead salts with potassium chromate or dichromate solution, the authors use *s*-diphenylcarbazide as indicator, a violet coloration being obtained with a solution, acidified with acetic or hydrochloric acid, containing 1 part of chromate per million. Sufficient ammonium acetate must be added to the lead solution to ensure the absence of free mineral acid. A short time after the chromate solution has been added, a small drop of the liquid and one of an acetic acid solution of *s*-diphenylcarbazide are placed on filter paper so that they intersect without the lead chromate precipitate coming into contact with the indicator.

For the estimation of SO_4'' ions, the hot solution is precipitated by excess of standard lead nitrate solution, the liquid being then boiled with a few drops of hydrochloric acid and filtered. The excess of lead in the combined filtrate and washings is determined by titration with potassium chromate solution after removal of the free acid by means of ammonium acetate. T. H. P.

Rapid Electro-analysis. H. Alders and Arthur Stähler (*Ber.*, 1909, **42**, 2685—2695).—The rapid electrolytic estimation of several metals in the form of liquid or solid amalgams is described. The apparatus consists of a Jena flask, 75—100 c.c. capacity, with an injecting bottom, through which are sealed three short platinum wires resting externally on a sheet of copper. An annular ring of mercury just covering the platinum points serves as the cathode, whilst the anode is a flat coil of platinum-iridium wire, the straight axis of which, passing through a filter funnel resting on the neck of the flask, is attached to a stirrer making 400—600 revolutions per minute. With this apparatus and a current of 3—4 amperes at 5—6 volts, good estimations of the metal in copper, silver, and mercury salts are obtained in ten to fifteen minutes, but not with salts of lead, iron, or zinc, since the liquid amalgams suffer oxidation during the washing. Mercury has been estimated in the presence of an arsenate in dilute nitric acid solution, but the rapid estimation of lead in the presence of arsenic or of phosphoric acid cannot be accomplished in the form of a liquid amalgam. When, however, a known quantity of mercuric chloride solution is added to that of the lead salt, and the electrolysis is conducted in the presence of a little 33% phosphoric acid (to prevent the formation of peroxide at the cathode) and nitric acid, which are neutralised by sodium hydroxide towards the end of the analysis, the lead is quantitatively separated as a solid amalgam in fifteen to twenty minutes. In the same way, lead can be estimated in the presence of potassium arsenate if mercurous nitrate is used instead of mercuric chloride. C. S.

Improved Process for the Iodometric Estimation of Copper. E. V. VIDEGREN (*Zeitsch. anal. Chem.*, 1909, 48, 539—545).—The deposit of metallic copper formed by treating the copper solution obtained in the usual way with aluminium is not redissolved in nitric acid, but dissolved in hydrochloric acid with addition of potassium chlorate. After adding dilute sulphuric acid, the solution is evaporated to expel the chlorine and most of the hydrochloric acid, and the residual liquid is then at once ready for the usual titration with potassium iodide and sodium thiosulphate. If, however, antimony or arsenic should be present, it is necessary to neutralise the mineral acids by addition of a sufficiency of sodium acetate.

Supposing about 0·5 gram of copper to be present, the liquid before titration should be diluted to about 20 c.c., and 8 c.c of 50% potassium iodide solution should be added. If the thiosulphate contains 39·3 grams of the salt per litre, 1 c.c. = 0·01 gram of metallic copper. The solution should be standardised occasionally, starting from pure metallic copper. L. DE K.

Cuprous Acetylide in Analysis. JOHANNES SCHEIBER (*Zeitsch. anal. Chem.*, 1908, 48, 529—538).—Copper is precipitated quantitatively by acetylene in presence of hydroxylamine in ammoniacal solution. If the precipitate is collected on a Gooch filter and washed first with water and then with alcohol and ether, it may be converted into cuprous carbide by heating for about two hours at 100° in a current of absolutely dry carbon dioxide.

As the precipitate is credited with explosive properties, it may be converted into sulphide by digesting with weak ammonium sulphide (free from polysulphide) or with a boiling solution of sodium sulphide. The sulphide is then heated with a little sulphur in a current of hydrogen, and finally weighed as cuprous sulphide. The precipitate may also be heated with dilute sulphuric acid on the water-bath, and oxidised by means of permanganate. After adding excess ot sulphurous acid, the solution is filtered and neutralised with ammonia; it is then slightly acidified with hydrochloric acid, and the copper precipitated by means of ammonium thiocyanate. The cuprous thiocyanate is dried at 120—130° and weighed as such. L. DE K.

Use of *s*-Diphenylcarbazide in Volumetric Analysis. Estimation of Mercury in Mercurous Salts. BERNARDO ODDO (*Gazzetta*, 1909, **39**, i, 666—671. Compare Abstr., 1903, ii, 758).—With mercurous salts, *s*-diphenylcarbazide yields an intensely blue diphenylcarbazone, which is stable towards nitric acid. This coloration may be used as an indication in the volumetric estimation of mercurous salts. To a solution of mercurous nitrate, rendered almost neutral by means of sodium carbonate, $N/10$-sodium chloride solution is added from a burette until a drop of the supernatant liquid gives no coloration with *s*-diphenylcarbazide paper.

This method is also applicable to the estimation of mercurous mercury in presence of mercuric salts. In this case a known volume in excess of standard sodium chloride is added, and the precipitated mercurous chloride removed by filtration. The mercuric mercury is then precipitated as sulphide and the liquid filtered, and, after expulsion of the hydrogen sulphide by evaporation, titrated with a mercurous nitrate solution of known titre to determine the excess of sodium chloride employed. T. H. P.

Electrolytic Estimation of Nickel in Nickel Ores, Steel, Etc. C. S. TATLOCK (*Zeitsch. anal. Chem.*, 1909, **48**, 433—437).—This process has the advantage that not a single filtration is required. 0·5 Gram of the ore is dissolved in nitro-hydrochloric acid, and the whole is evaporated to dryness. The mass is then dissolved in hydrochloric acid and diluted with hot water to about 200 c.c. When cold, bromine water is added and then a slight excess of ammonia; the precipitate is redissolved in hydrochloric acid, and the iron and manganese again precipitated with bromine water and ammonia.

When the precipitate has fully settled and does not adhere to the sides of the beaker, the liquid is ready for electrolysis. A current of 2—4 amperes is used, and the operation is continued until the platinum electrode no longer increases in weight. If the amount of nickel is very large, it may be advisable to dissolve the metal of the electrode and to continue the electrolysis until the separation is complete.

The deposit should afterwards be examined for cobalt. This is best separated by means of ammonium phosphate from ammoniacal solution (Clark's process), and finally weighed as pyrophosphate. L. DE K.

Separation of Nickel from Iron by means of Ammonia. V. HASSREIDTER (*Zeitsch. angew. Chem.*, 1909, **22**, 1492).—The author states that nickel may be freed completely from ferric iron by a single precipitation with ammonia. In seven experiments there were used, respectively, 1 gram of iron and 0·25 gram of nickel, 1 gram of iron and 0·5 gram of nickel, 1 gram of iron and 0·75 gram of nickel, 1 gram of iron and 1 gram of nickel, 0·25 gram of iron and 1 gram of nickel, 0·5 gram of iron and 1 gram of nickel, and 0·75 gram of iron and 1 gram of nickel.

In each case the solution, measuring 50 c.c., was mixed with 200 c.c. of ammonia, D 0·92, and the nickel was then determined electrolytically in an aliquot part of the filtrate.

The results showed that practically no nickel had co-precipitated with the iron. L. DE K.

Indirect Volumetric Method for the Estimation of Chromium, Copper, Nickel, Cobalt, Zinc, and Lead. A. BACOVESCU and E. VLAHUTA (*Ber.*, 1909, 42, 2638—2642).—When solutions of chromium, copper, nickel, cobalt, zinc, or lead salts are treated with an excess of freshly precipitated manganous carbonate, $MnCO_3,H_2O$, or manganous hydroxide, the carbonate or hydroxide of the given metal is precipitated, and an equivalent quantity of manganous salt goes into solution. The precipitate can be removed and washed, and the manganous salt determined in the filtrate and washings by titration with potassium permanganate, using Volhard's method (Abstr., 1880, 141). It is essential that the metallic salts used should be soluble and also normal, and not acid or basic salts. The small amount of oxidation of the manganous hydroxide does not interfere with the reaction.

The following practical method is recommended. One or two drops of nitric acid are added to a mixture of equal volumes of *N*-solutions of manganous sulphate and potassium hydroxide (or carbonate). After the precipitate has settled, the clear liquid is run off, the precipitate removed to a filter, thoroughly washed until free from sulphate, and then introduced into an Erlenmeyer flask by means of the wash-bottle. The solution of the salt (chromium, copper, etc.) is added, care being taken that an excess of the manganous hydroxide or carbonate is present, and the mixture boiled for a few minutes. The precipitate is removed and washed, and the manganese estimated in the combined filtrate and washings.

When manganous carbonate is used, the method lends itself to the estimation of copper, chromium, and lead only. J. J. S.

Quantitative Volatilisation of Vanadic Acid from its Compounds by Heating in a Current of Carbon Tetrachloride Vapour. PAUL JANNASCH and HENRY F. HARWOOD (*J. pr. Chem.*, 1909, [ii], 80, 127—134).—An apparatus is used similar to that described for phosphoric acid (this vol., ii, 759), the receiver containing dilute nitric acid and the tubulated safety-trap water. Ammonium metavanadate is decomposed at a moderate red heat in a current of carbon tetrachloride vapour, the distillate in the receiver is evaporated to dryness, the residue is dissolved in dilute sulphuric acid, and the vanadium, obtained in the form of divanadyl sulphate by passing sulphur dioxide, is titrated with potassium permanganate after the removal of the excess of sulphur dioxide in a current of carbon dioxide. The vanadium in sodium ortho-vanadate can be estimated in the same way, the salt being dehydrated previously at 150—200° in a current of carbon dioxide.

The analysis of vanadinite and endlichite is carried out in a similar manner; the lead remaining as lead chloride in the boat and combustion tube is estimated as sulphate, the distillate in the receiver is evaporated, and the solution of the residue in dilute sulphuric acid is freed from arsenic by hydrogen sulphide and treated as above for the estimation of the vanadium. The chlorine in the minerals is estimated separately.

	PbO.	$PbCl_2$.	V_2O_5.	As_2O_5.	Gangue.	Total %.
Vanadinite	66·58	10·23	17·34	5·67	0·54	100·36
Endlichite	69·31	10·57	20·23	0·56	—	100·63

The method is also very convenient for the complete analysis of carnotite, only the moisture and carbon dioxide requiring separate estimation.

The vanadium in sodium vanadate is removed completely, whilst the phosphorus in sodium phosphate is unaffected, when the salts are heated separately in a current of carbon tetrachloride vapour. When a mixture of the two salts is treated in a similar manner, the vanadium is not quantitatively removed. When, however, the mixed salts and four times the amount of sodium chloride are heated in the current of vapour at the highest temperature the combustion tube can withstand, both vanadium and phosphorus are completely removed. C. S.

Estimation of Chlorine in Presence of Palladium, and Estimation of Palladium by Reduction with Alcohol in Alkaline Solution. ALEXANDER GUTBIER and FERDINAND FALCO (*Zeitsch. anal. Chem.*, 1909, 48, 555—559).—A modification of Frenkel's method (Abstr., 1893, ii, 195). The palladochloride is dissolved in water, and pure aqueous sodium hydroxide is added until the precipitate formed has redissolved. Excess of alcohol is added, and, after covering the beaker with a watch-glass, it is placed in a boiling water-bath until the alcohol has evaporated. The addition of alcohol and its removal by evaporation are then repeated at least once, and after boiling the solution on an asbestos plate for some time, the slightly cooled liquid is poured through a filter and the precipitated palladium is washed with boiling water by decantation until every trace of alkali is removed, and then it is collected on the filter, dried, and ignited, first in the air, then in hydrogen, and finally in a current of oxygen-free carbon dioxide.

The filtrate and washings are evaporated to a small bulk, and, after acidifying with nitric acid, the chlorine is estimated gravimetrically in the usual manner as silver chloride. L. DE K.

Detection of Ethyl Alcohol in Chloroform. ARNALDO RUSCONI (*Arch. Farmacol. sper. Sci. affini*, 1909, 8).—The presence of as small a proportion of alcohol as 0·1% in chloroform may be detected as follows. To 10—15 c.c. of the chloroform in a thick-walled test-tube are added 1 c.c. of 10% potassium dichromate solution and 1 c.c. of

N-sulphuric acid. The tube is closed by a perforated cork, through vhich passes a tube leading into 3 to 5 c.c. of water contained in a test-ube. About one-third of the chloroform is then distilled off by means f a water-bath, and to the distillate are added 2 to 3 drops of about % sodium nitroprusside solution and 1 to 2 drops of dimethylamine olution. A blue coloration is obtained if the original chloroform conains 0·1% or more of alcohol. If the chloroform is to be tested for cetaldehyde, it is distilled directly and tested without oxidising.

T. H. P.

Iodometric Estimation of the Oxygen in Quinols and in hromic Acid. Angelo Casolari (*Gazzetta*, 1909, 39, i, 589—594). —It has been shown by Valeur (Abstr., 1900, ii, 57) that quinones erived from benzene may be estimated by treating them with otassium iodide in presence of hydrochloric acid and alcohol, the odine liberated being then measured by titration with standard sodium hiosulphate solution. In presence of an alkali instead of an acid, this eaction may be constrained to proceed in the opposite sense, thus: $C_6H_4(OH)_2 + I_2 + 2KHCO_3 = C_6H_4O_2 + 2KI + 2H_2O + 2CO_2$, and may hus serve for the estimation of quinols. The estimation is carried ut as follows. To a known volume of a 0·1*N*-solution of the quinol, iluted with 5 to 6 times its volume of water, are added a few c.c. of ·1*N*-potassium hydrogen carbonate solution; 0·1*N*-iodine solution is hen run from a burette into the liquid until the latter gives a ersistent coloration with starch paste. Further, the amount of odine in a solution may be estimated by adding a known volume in xcess of standard quinol solution, and determining the excess of the atter by titration either with 0·1*N*-iodine solution or with the iodine olution under examination.

Chromic acid in solution may be estimated by acidifying with hydrohloric or sulphuric acid and treating with a known volume in excess of ·1*N*-quinol, the excess of the latter being measured by adding otassium hydrogen carbonate and titrating with 0·1*N*-iodine solution.

T. H. P.

Reaction of Pyrogallol. Ottorino Carletti (*Boll. Chim. Farm.*, 909, 48, 441—442).—When treated with sulphuric acid and lcoholic tartaric acid in the manner described previously (compare his vol., ii, 528), pyrogallol yields a liquid which exhibits violet striæ nd ultimately assumes a uniform, intense violet colour; this colour isappears on dilution of the solution with water. If lactic acid s used in place of the tartaric acid, the coloration obtained is orangeed, and does not disappear when the liquid is diluted.

Tartaric acid solutions are readily attacked by moulds, with ormation of aldehydic compounds. Such altered solutions give olorations with various reagents without the heating necessary to btain Möhler's reaction and its modifications. Thus such a solution ives with guaiacol a bluish-violet, and with phenol a distinct roseed, coloration. T. H. P.

Estimation of Acetone in Urine by means of Extraction. Vilhelm Vaubel (*Zeitsch. öffentl. Chem.*, 1909, 15, 241—243).—An attempt to extract acetone from its solutions by means of chloroform previous to titration with iodine. Although dilute aqueous solutions to which sodium chloride has been added yield about 90% of the acetone present to the chloroform, the process fails with urines owing to the presence of urea, ammonia, and phosphates; sugar and albumin also interfere. L. de K.

Detection of Sugar in Urine. Gösta Bohmansson (*Biochem. Zeitsch.*, 1909, 19, 281—290).—By shaking urine with animal charcoal and hydrochloric acid, or alcohol, no sugar is absorbed, but other substances are, which give a false Almén's reaction, and among these is urochrome. Pflüger's conclusion that the copper test for sugar in urine is the only trustworthy one is therefore disputed.

W. D. H.

Esterification of Certain Fatty Acids on Evaporation of their Alcoholic Solutions. William H. Emerson and H. N. Dumas (*J. Amer. Chem. Soc.*, 1909, 31, 949—951).—Experiments showing that a considerable esterification takes place on prolonged boiling of stearic and palmitic acids with alcohol. A slight esterification takes place even on merely evaporating the alcoholic solution of these acids. When titrating the free acids in alcoholic solution, tetrachlorophenolphthalein is recommended as being superior to phenolphthalein. L. de K.

Simple Fat Extraction Apparatus. L. T. Bowser (*J. Amer. Chem. Soc.*, 1909. 31, 947—949).—A combination of Dubois' flask (Abstr., 1908, ii, 611) and Hopkins' condensing arrangement (*J. Amer. Chem. Soc.*, 1898, 20, 965).

The mercury cup differs somewhat from that used by Dubois in the internal shape of the maple ring, and in that a flat cork is used instead of a rubber stopper. The flask containing the fat is well wiped and dried, and cooled for at least 30 minutes before weighing. The fat is then removed by repeated washing with ether, and, after drying and cooling, the flask is re-weighed. L. de K.

Estimation of Camphor in Officinal Spirit of Camphor. Ernst Deussen (*Arch. Pharm.*, 1909, 247, 307—313).—The authorised tests of the % of camphor in spirit of camphor are not altogether satisfactory, and do not determine whether natural or synthetic camphor has been used. The author recommends the adoption of a polarimetric examination, and also the following method of estimation. Five grams of spirit of camphor, 20 grams of a cold saturated solution of ammonium sulphate, and 30 grams of ice in small pieces are shaken together until the ice is nearly melted. The precipitated camphor is collected, thoroughly washed with water at 0°, dried, and weighed; it is then oxidised by nitric acid, when *d*-camphoric acid, m. p. 187°, or *i*-camphoric acid, m. p. 204—205°, is obtained, according as the camphor is the natural or the synthetic product. C. S.

Coniine, Conhydrine, ψ-Conhydrine, γ-Coniceine, and a New Isomeride of Coniine. Walter J. Dilling (*Pharm. J.*, 1909, [iv], 29, 34—36, 70—72, 102—104).—A detailed account and critical examination of the chemical reactions of these alkaloids.

A new characteristic reaction for coniine is given. To the solution of the alkaloid or its salts is added a little sodium carbonate and a few drops of alcohol and carbon disulphide. The liquid is boiled, and, after adding excess of water and some drops of uranium nitrate solution, it is shaken with toluene. If coniine is present, the toluene turns red. The other related alkaloids do not give the reaction. The reaction may be confirmed by means of Nessler's reagent, which, in very dilute solutions, only precipitates the coniine.

The conhydrine and ψ-conhydrine are characterised by the crystalline appearances of the ethereal residues and of their sublimates.

L. de K.

New Reaction to Distinguish between α- and β-Eucaines. Distinction from Cocaine and its Substitutes. Umberto Saporetti (*Boll. Chim. Farm.*, 1909, 48, 479—482).—With a solution of iodine in potassium iodide solution, both α- and β-eucaines give precipitates, the first a chestnut-yellow and the second a rust-coloured precipitate (compare Candussio, this vol., ii, 450); such slight difference between the colours of the two precipitates does not admit of a definite distinction between the two compounds being made in this way.

For this purpose, however, saturated aqueous bromine solution may be used. With a 1% solution of β-eucaine, this reagent gives an abundant yellow precipitate, which partly dissolves on heating, and, on boiling the solution, is replaced by a white precipitate containing the bromine. With α-eucaine, on the other hand, the yellow precipitate formed by bromine water dissolves completely on boiling the solution, and similar behaviour is shown by cocaine, novocaine, stovaine, alypine, and nirvanine; in the case of the last, the liquid, on boiling, turns almost red and emits a pleasant fruity odour.

The reactions of these various anæsthetics with mercurous chloride, potassium iodide, solution of iodine in potassium iodide, mercuric chloride, sodium hydroxide, and potassium permanganate are described and tabulated.

T. H. P.

A Reaction of the Methylenic Ether Group in the Aromatic Series. A. Labat (*Bull. Soc. chim.*, 1909, [iv], 5, 745—746).—The reactions of guaiacol, catechol, and morphine with hydrastine, hydrastinine, and narcotine (this vol., ii, 710) are not given by berberine and narceine; but the gallic acid reaction is given by the latter two alkaloids, and also by heliotropine, piperine, apiole, safrole, and *iso*safrole. In the case of the last four substances, however, very dilute solutions must be used to avoid masking the green by the intense red colour they produce with sulphuric acid alone. The author points out that the one common group in these substances is the ortho-methylenic ether group, and suggests that the reaction may be characteristic of this function.

E. H.

New Adulteration of Pyramidone. Umberto Saporetti (*Boll. Chim. Farm.*, 1909, **48**, 367—370).—A sample of commercial pyramidone examined by the author was found to contain 50·8% of acetanilide. The latter may be approximately estimated by treating the sample with a known weight of benzene, drying the insoluble residue at 50°, and weighing; an allowance should be made for the amount of acetanilide dissolved by the benzene employed. T. H. P.

Estimation of Urinary Indican. T. Imabuchi (*Zeitsch. physiol. Chem.*, 1909, **60**, 502—519).—The copper sulphate method as recommended by Salkowski and others for the estimation of urinary indican is found to be more accurate than Obermayer's ferric chloride method. It gives higher results than Obermayer's reagent, but the overplus is not always constant. W. D. H.

Modification of Grimbert's Process for the Detection of Urobilin in Urines. Blanc and Rameau (*Ann. Chim. anal.*, 1909, **14**, 217—219).—The authors recommend Grimbert's process (Abstr., 1904, ii, 460), but find that the quantity used for the test (30 c.c.) should vary according to the amount of urine passed during twenty-four hours, the normal amount being taken as 1500 c.c.

The quantity taken for the test in c.c. should be 30 × vol. passed in twenty-four hours /1500; 20 c.c. of Denigès' reagent are added, and, after ten minutes, the liquid is filtered and treated according to Grimbert's directions. L. de K.

Preservation of Urine [for Analysis] by Thymol and Refrigeration. F. W. Gill and Harry S. Grindley (*J. Amer. Chem. Soc.*, 1909, **31**, 695—710).—Winchester quart bottles are rinsed with a 10% alcoholic solution of thymol, drained, and dried, with the result that a thin layer of thymol covers the entire inner surface of the bottle. From 0·2 to 0·3 gram of powdered thymol is also placed in the bottle, into which the human urine is discharged directly. The bottles are kept in refrigerators at 5° to 18°. The chlorine, phosphorus, total sulphur, inorganic sulphur, total nitrogen, and urea nitrogen in normal urines, thus preserved for thirty-two days, can be estimated as accurately and as satisfactorily as in fresh urine, and the same is true for the uric acid content after sixteen days' preservation. The quantitative change in the creatinine content is insignificant, but the results of the experiments are not conclusive as to the influence of the preservation on the organic sulphur, the total acidity, and the ammonia-nitrogen determinations. C. S.

Animal Fæces. II. Estimation of Fatty Matter in Animal Fæces by Ether and Carbon Tetrachloride. A. D. Emmett (*J. Amer. Chem. Soc.*, 1909, **31**, 693—695. Compare this vol., ii, 528).—The promiscuous use of ether or carbon tetrachloride for the extraction of the fatty matter in animal fæces is not permissible, for experiments on swine-dung show that carbon tetrachloride extracts in twelve hours 17·9 to 33·8% more of the fatty matter than does dry ether in twenty four hours. C. S.

General and Physical Chemistry.

Variation of the Magnetic Double Refraction of Aromatic Compounds with Temperature. Supercooled Substances and Substances in the Vitreous Condition. A. Cotton and Henri Mouton (*Compt. rend.*, 1909, **149**, 340—342. Compare Abstr., 1907, ii, 727; 1908, ii, 2, 745).—The magnetic double refraction of nitrobenzene falls with rise of temperature from 128·6′ at 6·4° to 90·9′ at 53·9°. The rate of fall is nearly constant, but diminishes slightly as the temperature rises. In the case of salol the variation of the double refraction with the temperature between $-17°$ and $+50°$ can be represented by $\beta = \beta_0 (1 - 0{\cdot}002t)$, in which β_0 is the value of the double refraction at 0°. The behaviour of the salol, which is in the supercooled condition below 41·5°, is therefore quite normal. Experiments with betol in the vitreous condition show also that this has a very considerable magnetic double refractive power. H. M. D.

Anomalous Dispersion by Metallic Vapours. P. V. Bevan (*Phil. Mag.*, 1909, [vi], **18**, 407—411).—There being no special property of sodium which would lead one to suppose that its vapour alone should give anomalous dispersion, the author has made experiments with lithium and potassium. The apparatus was similar to that used by Wood for sodium, and each of the above metals exhibited the phenomenon in question.

In the case of lithium, a considerably higher temperature is required than for sodium. The anomalous dispersion takes place in the region of the red lithium line, λ 6705, and there is no trace of anomalous dispersion in the region of the other lithium lines in the visible spectrum. It cannot yet be decided whether anomalous dispersion takes place near the other lines of the primary series for lithium, as is the case with sodium and potassium, since these lines are in the ultra-violet.

The temperature required for potassium is not as high as in the case of sodium. The chief region of anomalous dispersion is about the first pair of the primary series (λ 7699, 7665); it also appears at the pair of lines λ 4047, 4044, which are the second pair of the primary series.

In all experiments the gas present in the tube was hydrogen, and the effect showed very clearly both at a low pressure and at a pressure somewhat greater than one atmosphere.

In the case of potassium the dispersion spectrum is unsymmetrical about the mean position of the two red lines, one of the lines being more intense than the other in the emission spectrum. The same phenomenon occurs in the case of sodium, and the same seems to be true of the dispersion due to lithium, indicating that the lithium line is a double line with one component stronger than the other.

T. S. P.

Constitution of the Spectral Lines of the Elements. I. L. JANICKI (*Ann. Physik*, 1909, [iv], 29, 833—868).—The spectra were produced by means of an electric arc formed between a Wehnelt cathode and an anode of the metal under examination, and an echelon spectroscope of high resolving power was used in the determination of the structure of the lines. The elements examined were aluminium, magnesium, silver, zinc, tin, cadmium, cobalt, copper, lead, manganese, calcium, chromium, thallium, and mercury. The detailed measurements are compared with previous observations relating to the structure of the spectral lines. H. M. D.

Influence of the Medium on the Lines of Spark Spectra. HEINRICH FINGER (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 329—356; *Ber. Deut. physikal. Ges.*, 1909, 11, 369—376).—The spectra of the spark discharge under water between poles of various metals have been photographed and compared with the spectra obtained when the spark discharge took place in air. The following metals were used: silver, aluminium, calcium, cadmium, cobalt, chromium, copper, iron, mercury in the form of copper amalgam, magnesium, nickel, lead, platinum, tin, tantalum, thallium, and zinc.

The measurements were confined, in most cases, to that part of the spectrum lying between the wave-lengths 2000 and 4700. For each element, details are given of the effect of the water on the lines of the air spectrum, as to whether they are weakened, enhanced, reversed, suppressed, etc. In one case only, that of tantalum, does water have practically no effect. T. S. P.

Method of Producing an Intense Cadmium Spectrum, with a Proposal for the use of Mercury and Cadmium as Standards in Refractometry. T. MARTIN LOWRY (*Phil. Mag.*, 1909, [vi], 18, 320—327).—The essential properties for a standard source of light are: (1) that it should be of sufficient intensity to be used for all the various types of optical measurements, so that, for instance, refractive indices and optical and magnetic rotatory powers may be determined for the same wave-lengths; (2) that it should be strictly monochromatic and as far as possible free from satellites; and (3) that it should be produced with sufficient readiness to render it generally available. These requirements are only partly fulfilled by sodium light, which possesses the drawbacks inseparable from the use of a doublet, and fail completely in the case of the hydrogen spectrum.

It is suggested that mercury and cadmium should replace sodium and hydrogen. The enclosed mercury arc gives a very strong source of light, and of the six chief mercury lines, the green (5460·97) and violet (4358·58) have already proved to be of the utmost use in polarimetry. The green line can be read with a considerably smaller half shadow angle, and gives readings about 15% larger than the sodium doublet; the violet line can be read with a half-shadow angle of only 6°, the readings only differing from one another by a hundredth of a degree.

For obtaining the cadmium spectrum, the author uses an arc burning between two rods rotating in opposite directions; the rods consist of an alloy of silver and cadmium. It is suggested that the three cadmium lines, 6438 (red), 5086 (green), 4800 (blue), should be used. The green line is even brighter than that of mercury, and can be read with a half-shadow angle of 3° or less.

Finally, it is suggested that the mercury line Hg 5461 should be used as chief standard in optical work of all kinds, and that dispersion should be measured from this line to Hg 4359. T. S. P.

Band Spectrum of Barium and the Structure of the Bands in the Compound Spectra of Barium Halogen Compounds. LUDWIG BÖRSCH (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 297—326).—Detailed measurements of the lines in the band spectrum of barium between $\lambda = 5000$ and $\lambda = 7200$ are recorded and the data compared with those of previous observers. The source of light in the author's experiments was a coal-gas oxygen flame. into which barium nitrite was introduced. An arrangement is described by means of which a highly luminous flame can be obtained by allowing the dry finely powdered salt to fall into the flame through a narrow funnel tube provided with an electrical tapper. The bands which are observed in these circumstances are attributed to molecules of the metal. Bands attributed to barium halogen compounds were obtained in experiments with barium halides. The formation of these bands was found to be facilitated by the addition of the corresponding ammonium salt, the effect of this being to diminish the dissociation of the barium compound. H. M. D.

Effect of Pressure on the Band Spectra of the Fluorides of the Metals of the Alkaline Earths. R. ROSSI (*Proc. Roy. Soc.*, 1909, 82, *A*, 518—523).—The bands of the fluorides of the alkaline earth metals, which exhibit a marked Zeeman effect, have been investigated with the object of ascertaining whether they also show a large pressure-shift effect. The fluorides examined were placed in the positive carbon of an arc lamp contained in a pressure cylinder. The data show no obvious relationship between the magnitudes of the two effects, for whereas in the case of the calcium fluoride bands the displacements due to pressure are proportional to the magnetic separation, the greater Zeeman effect corresponds with the smaller pressure-shift in the case of the barium fluoride bands. H. M. D.

Absorption Spectra of Certain Salt Solutions. HARRY C. JONES and W. W. STRONG (*Physikal. Zeitsch.*, 1909, 10, 499—503).—A summary of observations previously recorded. H. M. D.

Absorption Spectra of Solutions of Neodymium. BORIS STAHL (*Le Radium*, 1909, 6, 215—219).—Owing to the uncertainty which still exists as to the elementary nature of neodymium and praseodymium, the author has investigated the absorption spectra of solutions of their salts.

Starting with a complete set of fractions of the nitrates which had been obtained in the separation of the neodymium from praseodymium, the bismuth, magnesium, and greater part of the manganese present were first eliminated. The last traces of manganese were extremely difficult to remove; one or other of the two following methods was used, although neither was absolutely satisfactory. 1. The metals were precipitated as oxalates, and the precipitate dried and ignited. The resulting oxides were treated with a solution of potassium chlorate in concentrated nitric acid. The praseodymium and neodymium dissolved as nitrates, the manganese remaining as peroxide. 2. The solution of the nitrates was evaporated to dryness on the water-bath, and the residue heated for two hours at 260—280°. The nitrate of manganese forms the peroxide under these conditions, whilst the nitrates of neodymium and praseodymium are unaltered.

After treatment in either of the above ways, the amount of manganese remaining was extremely small, and did not interfere with the measurement of the absorption spectra.

In order to obtain the solutions for spectroscopic examination, the oxides were prepared by calcination of the oxalates, and then either the nitrate or the chloride prepared from the oxide. The solution of the nitrates was unsatisfactory for the purposes of the investigation, since the absorption spectra of the neutral solution was altered considerably by the addition of free nitric acid. The chlorides gave the same spectra, however, both in neutral and hydrochloric acid solution.

A 10% solution of neodymium chloride, 1 cm. thick, shows 20 bands ranging from λ 742 to λ 347; as the solution is diluted, a number of these bands split up into their components, while concentration of the solution causes a number of the bands to coalesce. Taking into account these facts, the complete absorption spectrum of neodymium is found to consist of 29 bands, ranging from λ 742 to λ 328.

The absorption spectrum of praseodymium contains only five bands, ranging between λ 597 and λ 444. Dilution has no effect on these bands, except to render them more feeble.

Examination of the fractions intermediate between neodymium and praseodymium showed that only the bands λ 482 and λ 444 are eliminated as the fractions become poorer in praseodymium. The bands λ 597 and λ 589 of praseodymium are close to the bands λ 579 and λ 572 of neodymium, and at certain concentrations they cannot be distinguished from each other. The band λ 469 is the same for both elements, and because of this it has been supposed that both praseodymium and neodymium contain another element which cannot be separated from them. The spectra of the intermediate fractions show, however, that at no point does this band become enhanced, and consequently it cannot be due to a third element. This shows the necessity, in all such investigations, of examining the intermediate fractions.

Both neodymium and praseodymium are to be considered as elementary substances. T. S. P.

Absorption Spectrum of *p*-Xylene in the Ultraviolet. Wilhelm Mies (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 357—368).—Former investigators (Abstr., 1906, ii, 410; 1908, ii, 213) having made reference to the regular band spectrum of *p*-xylene in the ultraviolet, the author has investigated the absorption in the ultraviolet of *p*-xylene vapour and also of solutions of *p*-xylene in alcohol. The source of light was the spark discharge between aluminium electrodes immersed in water.

The absorption spectrum of *p*-xylene vapour was measured under atmospheric pressure at 3°, 15°, 30°, 40°, 70°, and 90°, with the following results. In no case is there an alteration in the selective absorption. Neither temperature, nor thickness of the absorbing layer, nor pressure have any influence on the heads of the bands. There is no evidence of broadening of the bands. With a constant thickness of the absorbing layer, rise in temperature appears to increase the intensity of the heads of the bands of the longest waves.

The general absorption increases with the temperature and with the thickness of the absorbing layer. It is most marked towards the red end of the spectrum, and gradually decreases in the direction of shorter wave-lengths, until at $\lambda = 2389$ it becomes zero.

The spectrum is a very pronounced band spectrum, in which the individual bands are not resolved. All the bands have their edges towards the violet, and become diffuse towards the red. The spectrum is a very regular one, and tables are given in which the regularities existing between the bands of the various series are brought out.

The concentrations of the alcoholic solutions of *p*-xylene of which the absorption was measured were 50%, 20%, 10%, $\frac{1}{2}$%, and $\frac{1}{50}$%. As the concentration increases, there is a marked displacement of the absorption towards the red. This displacement is not connected with a broadening of the bands.

The liquid spectrum is displaced 10—14 Ångström units towards the red with respect to the vapour spectrum. T. S. P.

Behaviour of the Phosphorescent Sulphides of the Alkaline Earths at Various Temperatures, and Particularly at very low Temperatures. PHILIPP LENARD, H. KAMERLINGH ONNES, and W. E. PAULI (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 157—174. Compare also Abstr., 1905, ii, 565 ; this vol., ii, 283 ; ii, 630).—Previous investigations have shown that the phosphorescence bands of "phosphors" (phosphorescent sulphides) become narrower and sharper as the temperature is lowered, the lowest temperature used being −180°. The experiments have now been extended to a temperature of −259°, using liquid and solid hydrogen. The phosphors used contained (1) calcium, copper, and lithium ; (2) calcium, sodium, and manganese ; (3) calcium, nickel, and fluorine ; (4) calcium, sodium, and bismuth ; (5) strontium, zinc, and fluorine ; (6) strontium, sodium, and manganese ; (7) strontium, sodium, and bismuth ; (8) barium, copper, and lithium ; and (9) barium, bismuth, and potassium. Phosphorescent zinc sulphide, the double fluoride of uranyl and ammonium, and uranyl nitrate were also examined.

It is found that the sharpness of the bands continually increases as the temperature is lowered. To each band of the phosphorescent light there belong three phases, which succeed each other in the following order as the temperature falls : (1) the upper momentary phase, or heat phase ; (2) the permanent phase ; (3) the lower momentary or cold phase. The temperature of solid hydrogen (−259°) is low enough to bring all bands of the phosphors of the alkaline earths into the lower momentary phase. When a phosphor is warmed after excitation by light, those bands appear in succession the temperature ranges of whose permanent phase succeed each other on the scale of temperatures.

The response to ultra-red at these low temperatures is very marked. As a general rule, the actual lighting up is far more striking than the subsequent extinction.

The excitation-distribution corresponding with the various phosphorescence bands is independent of the temperature.

Other experiments deal with the momentary and permanent parts of the spectral excitation, with the non-resolution of bands in amorphous substances, and with the upper temperature limits to the excitation of phosphorescence by light and on the glow of phosphors when heated in flames, or when crushed at high temperatures. T. S. P.

Decomposition of Carbon Dioxide by Ultraviolet Rays. H. Herchefinkel (*Compt. rend.*, 1909, **149**, 395—396).—Thiele has shown that exposure to ultraviolet light brings about combination of carbon monoxide with oxygen (Abstr., 1908, ii, 79); the present author finds that the action is reversible, considerable quantities of carbon monoxide being formed when dry carbon dioxide is exposed in quartz vessels, in the presence of mercury, to the action of the light. The author confirms Cameron and Ramsay's observation that this decomposition is also effected by radium emanation (Trans., 1908, **93**, 981).

W. O. W.

Sterilisation by Ultraviolet Rays. Application to Butter. Dornic and Daire (*Compt. rend.*, 1909, **149**, 354—356).—Experiments on the sterilisation of the water employed for washing butter from pasteurised cream by means of ultraviolet rays showed that the number of colonies per c.c. was reduced to a tenth or less. Butter which had been washed with the partly sterilised water remained fresh for two to three weeks longer than butter washed with ordinary water.

The direct sterilisation of butter by ultraviolet rays is probably impossible, owing to its opacity, and the butter acquires an unpleasant odour and taste, due to the ozone produced by the lamps.

N. H. J. M.

Ionisation of Gases by Light. Johannes Stark (*Physikal. Zeitsch.*, 1909, **10**, 614—623).—From the standpoint of the theory previously put forward (Abstr., 1908, ii, 545, 574, 746, 911, 1007), the author discusses the conditions which are necessary for photo-ionisation, and also the methods which can be used to detect such ionisation. It is shown that the absorption of light in bands of long wave-length will not cause ionisation of the absorbent atom or molecule, whereas ionisation will take place in bands of short wave-length if the radiation is sufficiently concentrated.

Three methods are discussed by means of which ionisation by light may be detected, namely: 1. From photoelectric experiments. 2. By conductivity measurements. 3. From experiments with canal rays.

The second method, which can only be used when the increase in conductivity of a gas due to illumination is large compared with the ordinary conductivity, is discussed in detail, and it is shown that photo-ionisation may be detected as follows: The gas is submitted to a potential which is less than the ionisation potential, and the current flowing is measured while the gas pressure is diminished from a high to a low value; at the same time the gas is illuminated by light belonging to the region of its bands of short wave-length. If the current strength is a maximum at some particular gas pressure, again diminishing after the maximum has been reached, photo-ionisation has been produced.

Experiments were carried out on the vapours of anthracene, diphenylmethane, α-naphthylamine, and diphenylamine, which were contained in quartz vessels illuminated by the light from a mercury lamp, so that the light used varied between 185 and 380$\mu\mu$. The pressure of the vapour undergoing examination was varied by varying the temperature.

The vapours of these four substances show the following behaviour: At a potential of 2 volts between the electrodes, and high pressure, the current flowing is small; as the pressure falls, the current increases to a maximum, then falls to a minimum, and finally begins to increase once more. This is indicative of photo-ionisation.

For each substance the pressure (calculated to be 50 mm.) at which the ionisation was a maximum was kept constant for some time, and the potential submitted to cyclic variations from 0—12·6—0 volt in steps of 2·1 volts, the current being measured at the same time. At potentials greater than 2 volts, the current increases less rapidly than at lower potentials, but even at 10 volts there is no sign of saturation. This result is explained in the light of the author's theory of valence electrons.

The negative valence electrons, which are separated by the photo-ionisation, are supposed to come from the carbon atoms of the condensed benzene rings.

The vapours of benzene and naphthalene were not found to be suitable for the present investigation. T. S. P.

Radioactivity of Ordinary Matter. Max Levin and Rudolf Ruer (*Physikal. Zeitsch.*, 1909, 10, 576—579).—With the object of ascertaining whether radioactivity is exhibited by other than the recognised active substances, the authors have examined compounds of nearly all the known elements. The photographic method was used in the investigation, the plates being exposed to the action of the various compounds for about six months. The results obtained indicate that potassium and rubidium are the only two elements which have an undoubted specific activity. In most other cases the observed photographic effect is shown to be probably due to radium or thorium products. This explanation could, however, not be given to the positive, although feeble, results obtained in the case of antimonic, niobic, and tantalic acids (compare following abstract). H. M. D.

Radioactivity of Rubidium Compounds. Ernst H. Büchner (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 154—157).—Previous investigations (compare Abstr., 1907, ii, 597; 1908, ii, 448; this vol., ii, 288) have shown that potassium salts are either radioactive or else contaminated with a radioactive substance. In the latter case the impurity is probably one of the alkali metals, since it has been shown that it is not one of the known active substances. As a first step in the elucidation of the matter, the author has investigated whether other alkali salts have the same property as the potassium compounds. Cæsium, lithium, and sodium have been proved inactive by other investigators (Abstr., 1907, ii, 217; 1908, ii, 750), and the author has consequently only investigated rubidium salts, and for the sake of comparison, potassium and sodium salts. The photographic method was used, the radiations from the salts having to pass through air only, or through aluminium foil 0·001 mm. thick. Using the anhydrous sulphates in each case, an effect was obtained with rubidium sulphate only, the exposures lasting from 81 to 117 days. In no case was there an effect with potassium sulphate, a result which does not agree with that of previous observers.

The same result was obtained when rubidium sulphate was used which had been prepared by evaporating a solution in the dark, showing that the effect was not due to previous exposure of the salt to the light (compare preceding abstract). T. S. P.

Radium Content of Sea-Water. John Joly (*Phil. Mag.*, 1909, [vi], 18, 396—407).—The discrepancies between the author's and Eve's results (this vol., ii, 633) for the radium-content of sea-water are discussed, and a table is given summarising all the results obtained by the author. It is pointed out that in the determination of the radium content it is necessary to state the quantity of acid added to the sea-water under examination (compare Abstr., 1908, ii, 246). The effect of acidification is to increase the quantity of emanation liberated, but beyond a certain degree of acidification, small additions of acid seem ineffective in producing further change. In cases where much organic matter is present, the emanation may be retained to a considerable extent even after prolonged boiling.

The radium content varies from 2 billionths of a gram of radium per litre in the Mediterranean to 34 billionths of a gram on the coast round Ireland, and in discussing this distribution of the surface radioactivity of the ocean, the author comes to the conclusion that the carriage of radium-rich water from beneath upwards takes place. This surface radioactivity cannot be ascribed to the atmosphere, neither can it be due to the diffusion of emanation from the radium contained in the globigerina ooze. T. S. P.

Expulsion of Radioactive Matter in the Transformations of Radium. Sidney Russ and Walter Makower (*Physikal. Zeitsch.*, 1909, 10, 568).—Polemical against Hahn and Meitner (this vol., ii, 634). H. M. D.

Atomic Weight of Radium from Spectroscopic Data. W. Marshall Watts (*Phil. Mag.*, 1909, [vi], 18, 411—413).—Runge and Precht's rule, that the separations of homologous pairs of lines are proportional to some power of the atomic weight, although nearly true in many families of allied elements, is not strictly true in any one case. The diagram, in which the logarithms of atomic weights are plotted as ordinates and logarithms of separations as abscissæ, shows that the lines joining the points in each family of elements are not exactly straight, and this vitiates the calculation of the atomic weight of radium by Runge and Precht (Abstr., 1903, ii, 346), who made use of the straight line: $\log.(\text{at. wt.}) = 0{\cdot}02005 + 0{\cdot}5997 \log.x$, where x is the separation.

The line of slight curvature which passes through Mg, Ca, Sr, and Ba is represented almost exactly by the formula:

$$\begin{aligned}\log.(\text{at. wt.}) = 1{\cdot}886242 &+ 0{\cdot}623179 \ (\log. x - 2{\cdot}813121)\\ &- 0{\cdot}080391 \ (\log. x - 2{\cdot}813121)^2\\ &- 0{\cdot}0374175 \ (\log. x - 2{\cdot}813121)^4,\end{aligned}$$

and this gives 226·56 for the atomic weight of radium, which number is consistent with that obtained by chemical methods. It also gives the following atomic weights: Mg, 24·32; Ca, 40·08; Sr, 87·62; Ba, 137·41. T. S. P.

The Diffusion of Radium Emanation. L. CHAUMONT (*Le Radium*, 1909, **6**, 106).—The author has determined the coefficient of diffusion of radium emanation in dry air at 0° and 760 mm., which he finds to be 0·1015. From this the molecular weight is calculated to be 80. F. M. G. M.

The Diffusion of Actinium and Thorium Emanations. S. RUSS (*Le Radium*, 1909, **6**, 109).—Polemical against G. Bruhat (this vol., ii, 300). F. M. G. M.

Ionisation by Chemical Means. LÉON BLOCH (*Compt. rend.*, 1909, **149**, 278—279. Compare Reboul, this vol., ii, 718).—Certain unpublished observations of the author's appear to cast doubt on the results recently obtained by Reboul. The interaction of nitric oxide and oxygen, the dissociation of arsine in Marsh's apparatus, the production of sulphur trioxide by the contact process, the synthesis of hydrogen sulphide from its elements, and the phosphorescence of sulphur are all actions which appear to be unaccompanied by ionisation, whereas the phosphorescence of phosphorus is accompanied by ionisation. Moreover, according to several authors the formation of ammonium chloride fumes is not accompanied by ionisation. Further research will be necessary to test the theory that ionisation produced chemically originates in a splashing action at the interacting surfaces. R. J. C.

Charge of Gaseous Ions. J. FRANCK and W. WESTPHAL (*Ber. deut. physikal. Ges.*, 1909, 276—280).—The fact that positive ions with a double electric charge are produced in gases by the action of Röntgen rays has led the authors to examine whether such ions are generated by other ionising agents. The results of diffusion measurements indicate that singly charged positive ions only are produced by α- and β-rays and by the discharge of electricity from points. For

γ-rays the same experimental observations were made, but the authors consider that the experimental errors in this case are too large to permit of the definite conclusion that no doubly charged ions are produced.

Amongst the ions generated in point discharge, slowly moving positive and negative ions can be differentiated by the diffusion experiments. H. M. D.

Diffuse Reflection of the α-Particles. Hans Geiger (*Proc. Roy. Soc.*, 1909, **82**, *A*, 495—500; *Le Radium*, 1909, **6**, 201—203).—It has been found that a small fraction of the α-particles which fall on a metal plate have their directions changed to such an extent that they emerge again at the side of incidence. For plates of gold, platinum, tin, silver, copper, iron, and aluminium, the diffuse reflection diminishes with the atomic weight of the metal, but more rapidly than this The reflected fraction in the case of lead is less than would be expected according to this relationship.

Since the diffuse reflection is due to scattering, it follows that the number of particles reflected must vary with the thickness of the reflecting plate, and this was examined in the case of gold. The relationship between the two quantities is similar to that already obtained in the case of the reflection of β-particles. Compared with the thickness of gold which an α-particle can penetrate, the effect is confined to a relatively thin layer, about half the reflected particles coming from a layer equivalent to about 2 mm. of air.

From experiments with the α-particles from radium-*C*, it follows that of the incident particles about one in 8000 is reflected under the described conditions. This ratio is more or less independent of the angle of emergence. In the case of grazing incidence, however, the number of particles reflected at a very small angle to the reflector is largely in excess of the number corresponding with this ratio.

H. M. D.

Ionisation Produced by an α-Particle. Hans Geiger (*Proc. Roy. Soc.*, 1909, **82**, *A*, 486—495; *Le Radium*, 1909, **6**, 196—200).—Radium-*C* was used as a source of homogeneous α-rays, and the ionisation due to the whole number of α-particles expelled from a known quantity of this substance was measured at low pressure in such a way that only a small definite portion of the range of each α-particle was effective. In a further experiment, the ratio of the ionisation produced within this small portion of the range to the ionisation produced along the whole path was determined. As the mean result of several measurements, it is found that the average number of ions produced in air by an α-particle from radium-*C* along its whole path is $2{\cdot}37 \times 10^5$.

On the assumption that all α-particles produce the same ionisation at the same velocity, the number of ions produced by the different α-particles from the radium family has been calculated. For radium, radium emanation, radium-*A*, and radium-*F*, the numbers of ions are respectively $1{\cdot}53$, $1{\cdot}74$, $1{\cdot}87$, and $1{\cdot}62 \times 10^5$. H. M. D.

Primary and Secondary Gamma Rays. A. S. Eve (*Phil. Mag.*, 1909, [vi], 18, 275—291).—The author has examined the incident and emergent secondary radiations from a reversible pair of dissimilar metals traversed by the gamma rays (compare Bragg, Abstr., 1908, ii, 556). A rectangular brass electroscope was used, both ends of which had been removed and covered with thin aluminium foil. When using the primary γ-rays, the radium bromide was placed sometimes entirely inside a closed hollow cylinder of iron or lead of the desired thickness, and sometimes in a cylinder with an open end, which was then screened by plates of suitable metal (iron or lead). Plates of various substances were then placed at the ends of the electroscope, two at either end, and the ionisation current observed when they were interchanged in the four possible arrangements. When using the secondary γ-rays a somewhat similar arrangement was devised, the electroscope and plates being well screened from the radium by much lead; the secondary radiator generally consisted of four bricks on end, or a tinned iron pail filled with iron filings. The plates used consisted of lead, silver, zinc, copper, iron, aluminium, and carbon.

Change of hardness of the γ-rays makes little difference in the relative intensities of the incident corpuscular secondary radiation from various elements, and the intensities follow the order of atomic weights of the radiators. On the other hand, there is a marked difference in the relative intensities of the emergent corpuscular secondary radiation; such radiations do not follow the order of atomic weights, the curve, plotted with atomic weights as abscissæ and intensities of secondary radiation as ordinates, roughly resembling a parabola with the vertex downwards.

Hardening of the γ-rays is readily produced by lead screens, but not by iron screens of great thickness. On hardening the γ-rays the emergent radiation from carbon and aluminium is increased relatively to heavier substances; on softening, decreased.

With various radiators, and with the secondary rays due to the primary γ-rays from radium-*C*, the values of λ and λ/d, and the emergent corpuscular secondary radiations, were observed. These all indicate the soft character of the secondary γ-rays.

The γ-rays from uranium-*X* caused emergent radiation of a character, showing that these rays are softer than those from radium-*C*, and harder than the secondary γ.

When the plates are interchanged, as mentioned above, the four readings obtained are nearly in proportion. T. S. P.

The Influence of Cathode Rays on the Activity of Metallic Uranium. J. Olie, jun. (*Chem. Weekblad*, 1909, 6, 683—689. Compare this vol., ii, 10).—The author has repeated Jorissen and Ringer's experiments on the effect of cathode rays on the activity of metallic uranium, using an induction coil of 35 cm. spark. Contrary to their experience, he finds that the activity of the metal is not appreciably augmented by exposure to the rays. A. J. W.

Effect of Light on the Conductivity of Nitrogen Tetroxide Vapour. Mario Tenani (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 16—18).—The presence of nitrogen tetroxide facilitates the discharge of an insulated, positively charged platinum disk, but impedes that of a negatively charged disk. The explanation of the latter observation is that the nitrogen tetroxide absorbs the light and prevents it from reaching the metallic disk, the conduction being effected only by the ions formed by the action of the absorbed light in the body of the gas. T. H. P.

Electric Conductivity of Saline Flames. U. Gouttefangeas (*Ann. Chim. Phys.*, 1909, [viii], 17, 515—525).—Solutions of various salts were atomised by means of a spray, and the particles were carried forward by a stream of air, which was mixed with coal gas and burnt under a constant pressure. The current passing at constant voltage between two platinum electrodes at a fixed distance from the blue cone of the flame is a measure of the ionisation produced by the salt. The experimental error when all precautions are taken to ensure standard conditions of flame, voltage, etc., appears to be about 3%. The values obtained were corrected by subtracting the galvanometer reading when distilled water was employed instead of salt solution. Measurements were made with alkali and alkali earth chlorides, bromides, iodides, nitrates, sulphates, monohydrogen phosphates, formates, acetates, and benzoates in solutions of equimolecular strength. In general, salts of almost equal molecular weight produce almost equal conductivities, and the conductivity increases with increase of molecular weight. The author considers the acid group to have an effect which is small relative to the effect of the metal. The effect of potassium and sodium alone was approximately estimated by spraying their alkyloxides dissolved in alcohol into the gas, it being assumed that the ethoxy-group has no conductivity of its own. The acid group appears to account for less than 1/10 of the total conductivity.

Concentration of the solution employed leads to a corresponding increase in the conductivity imparted to the flame. The conductivity increases less rapidly than the concentration (compare Wilson, Abstr., 1899, ii, 722), but more rapidly than the square root of the concentration (Arrhenius, 1891). The theory put forward by Arrhenius that the salt is dissociated in the flame, thus: $MR + H_2O = \overset{+}{M} + \overset{-}{OH} + RH$, necessitates that all salts of the same metal should give the same conductivity, whereas the author claims that the acid group has a distinct, although small, influence. The salts of organic acids impart slightly lower conductivities to the flame than inorganic salts. It is suggested that, in addition to cathodic decomposition of the metal on the hot electrode, a certain amount of electrolytic dissociation occurs (compare Moreau, Abstr., 1903, ii, 125). R. J. C.

Electrochemical Behaviour of Nickel. A. Schweitzer (*Zeitsch. Elektrochem.*, 1909, 15, 602—610).—The potential of a cathode on which nickel is being deposited was determined in an atmosphere of hydrogen at various temperatures and current densities for normal solutions of nickel chloride and sulphate. The potentials were measured against the normal calomel electrode, the potential of which was taken as −0·283 volt. The potentials of a nickel anode were also measured in a similar way. The numerous results are given in tables and curves which show that the cathode potential becomes more positive as the current density increases and as the temperature falls, and the anode potential more negative at higher current densities and lower temperatures. The equilibrium potential between nickel and solutions of its sulphate and chloride was also determined. The results are (at 16°): nickel powder, charged with hydrogen in *N*-sulphate, 0·33 volt; in *N*/10 sulphate, 0·35 volt. Pure nickel sheet in *N*-sulphate, 0·307 volt; in *N*/10 sulphate, 0·336 volt. Nickel powder in *N*-chloride, 0·31 volt; in *N*/10 chloride, 0·36 volt. The potential required to deposit nickel, even with the smallest current density, is considerably higher than this. Possibly a nickel–hydrogen alloy is formed which gives higher potentials; on the other hand, the potential corresponding with the change $\mathrm{Ni} + 2F \longrightarrow \mathrm{Ni}^{\cdot\cdot}$ cannot, apparently, be measured if traces of oxygen are present. The potential measured in an atmosphere of hydrogen is therefore apt to err on the high side, whereas that obtained without hydrogen is probably too low. It is therefore probable that the real value for nickel in a normal sulphate solution lies between 0·2 volt (Schoch, this vol., ii, 370) and 0·33 volt.

T. E.

Electric Forces at the Junction of Two Phases. Fritz Haber and K. Klemensiewicz (*Zeitsch. physikal. Chem.*, 1909, **67**, 385—431). —The paper contains a theoretical and experimental examination of the differences of potential at the boundary of two electrolytically conducting phases containing the same substance or substances. Such differences of potential are probably important in connexion with the action of muscle. Muscle in action is negatively charged with reference to resting muscle, and, further, active muscle has an acid reaction. It is considered that the difference of potential between the two states of muscle is connected with this formation of acid; as the fluids of the body are mostly nearly neutral, the formation of traces of acid in one phase would produce a considerable difference of potential at the boundary of this phase with another. These differences of potential are doubtless also connected with surface-tension effects.

Expressions are obtained for the boundary differences of potential between phases containing water, one phase being an aqueous solution of an acid or alkali, the other an electrolytically conducting water phase; for example, ice or a liquid or solid solution of water. The formulæ obtained show that the *E.M.F.*'s in question vary with the acidity or alkalinity of the aqueous solution on either side of the neutral point, and their applicability has been proved by direct experiment, glass, benzene, toluene, and *m*-xylene being used as solvents for water.

For the measurements with glass, a tube of common Thuringian glass was blown out to a bulb at the end, the walls being 0·06 to 0·1 mm. thick; it was heated in steam for some time, and then kept in water until thoroughly soaked. It was then partly immersed in the acid or alkaline solution against which the difference of potential was to be measured, one electrode was placed in a conducting solution in the interior of the tube, the side-tube of a calomel electrode in the acid or alkaline solution, and the difference of potential measured in the ordinary way with an electrometer. In general, the concentration of the aqueous solution was progressively altered from $N/10$-acid to $N/10$-alkali, or vice versa, and the gradual alteration of potential with reference to the glass-water layer measured. The curves obtained by plotting the observed *E.M.F.* against the amount of alkali added to the originally acid solution, or vice versa, are double hyperbolas, one on either side of the neutral point. In the case of Thuringian glass, the total difference of potential was nearly 0·7 volt at 20°, and rather over 0·7 volt at 90°, in agreement with the theoretical value, but was less for Jena glass, and depended greatly on the treatment to which the glass was subjected.

In one series of measurements in which organic liquids were used as solvents for water, the aqueous solution (acid or alkaline) was placed in a quartz vessel, above this floated the organic liquid saturated with water, and the measurements were made by dipping the quartz side-tubes of normal electrodes into the lower and upper layers respectively. An *E.M.F.* in the required direction was observed, but the results were considerably affected by experimental error. G. S.

Electrical Stimulation of Catalytic Pulsations. GEORG BREDIG and J. W. KERB (*Verh. Naturhist. Med. Vereins Heidelberg*, 1909, 10, 23—29).—Nernst has recently shown (*Pflüger's Archiv*, 1908, 122, 275) that in physiological systems there is a quantitative relationship between the strength, i, of the alternating current required to produce a certain stimulus and the frequency, n, of the current, which may be represented by the equation $i/\sqrt{n}=k$, where k is a specific constant depending on the nature of the stimulus and the form of current used. It has already been shown that, when a fairly concentrated aqueous solution of hydrogen peroxide is poured on a clean surface of mercury, the system performs catalytic pulsations. These spontaneous pulsations can be stopped by addition of a trace of acid, but they commence again when the system is connected with an alternating current, and it is shown that, within the moderate range of frequency attainable with the available apparatus, the equation of Nernst holds for this case also. G. S.

Electromotive Force of Zinc Amalgams. ERNST COHEN and W. TOMBROCK (*Proc. K. Akad. Wetensch. Amsterdam.*, 1909, 12, 98—104). —If the Clark cell is to be used as a standard of electromotive force, it is necessary that the behaviour of zinc amalgams of varying concentrations should be investigated. The present communication gives an account of some measurements of electromotive force which have been made with this object in view.

In the first set of experiments the electromotive forces of combinations of a 10% amalgam with amalgams varying in concentration from 0·103% to 2·268%, and also with two rods of pure zinc which were two halves of the same rod, were measured. The electrolyte was an unsaturated solution of zinc sulphate, and the temperature, 0·5°. The results obtained with cells containing the zinc rod as one pole varied irregularly, showing that zinc in this form is unfit for potential measurements (compare Richards and Lewis, Abstr., 1899, ii, 267).

The *E.M.F.* of the amalgam cells gradually decreases as the concentration of the one amalgam increases, being 0·0285 volt with the 0·103% amalgam, and becoming zero with amalgams varying in composition from 1·34—2·268%. In all cases where there is an *E.M.F.*, the 10% amalgam forms the negative (solution) pole.

In the second set of experiments the electromotive forces of combinations of a 10% amalgam and amalgams varying in concentration from 2·57—60% were measured, and also the effect of time on the electromotive force. With amalgams up to 38·82%, the final electromotive force is of the order of a tenth of a millivolt; with the 60% amalgam it is 0·0009 volt.

The results show that where a potential between zinc and zinc amalgams does exist, it is always of such a nature that the zinc forms the negative pole. No further discussion can be given until the freezing-point curve of zinc amalgams has been investigated.

T. S. P.

Electrolysis with Magnesium Cathodes. Fr. Schmidt (*Chem. Zeit.*, 1909, 33, 911).—When a neutral solution of sodium chloride is electrolysed with a magnesium cathode, a thin film of magnesia forms on the surface of the cathode which entirely prevents the reduction of the hypochlorite which is formed at the anode. At high current densities the film breaks up, to some extent, exposing fresh surfaces of the metal, but with low current densities the consumption of magnesium is very small. Owing to the resistance of the magnesia film, a higher *E.M.F.* is required than with a platinum anode, but this can be compensated by using a lower current density. The concentration of hypochlorite which can be attained is no higher than it is with a platinum cathode; in both cases it is limited by the formation of chlorate.

In the electrolytic preparation of iodates or bromates, the loss by reduction at a platinum cathode is much larger than in the case of hypochlorite, and here the use of a magnesium cathode is of very marked advantage.

In the electrolytic oxidation of ammonia to alkali nitrite, the presence of iron (or other heavy metal) in the solution makes the artifice in question of no use, because the heavy metal is deposited on the surface of the magnesium. T. E.

Absorption and Mobility of Didymium Ions. Adolfo Campetti (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 53—58).—According to Lenard's results (Abstr., 1905, ii, 565), the ions of didymium in solution must be regarded as free, and not loaded with molecules of the solvent, since the characteristic vibrations observed with didymium glass, many solid didymium salts, etc., are also exhibited by solutions of didymium salts.

The author has determined the mobility of the didymium ion, both by conductivity measurements and by determination of the coefficient of transport.

Taking the mobility of the chlorine ion at 18° as 65·4, the conductivity measurements give the value 59·8 for the mobility of the didymium cation, whilst the transport experiments give the numbers 68·9 and 56·3 for the mobilities at 18° of the chlorine and didymium ions respectively.

The conclusion is drawn that, in solutions of didymium salts, a small proportion of the didymium ions are in a state of absolute freedom, and hence capable of exhibiting their characteristic vibrations, whilst the greater number of the ions are united with molecules of the solvent, so that the mean mobility bears no relation to the absorption produced by the solution. T. H. P.

Magnetic Properties of Carbon and Organic Compounds. P. Pascal (*Compt. rend.*, 1909, **149**, 342—345. Compare this vol., ii, 487).—Sugar charcoal is diamagnetic, and its magnetic susceptibility is $-5·2 \times 10^{-7}$ when that of water is taken as $-7·5 \times 10^{-7}$.

From the measurement of magnetic susceptibility of a number of organic compounds, it has been found that the values for isomeric substances of similar constitution are very nearly the same. The data indicate that the molecular magnetic susceptibility is approximately equal to the sum of the atomic susceptibilities. In open-chain compounds, double linkings diminish the diamagnetism; a measurable effect is, however, only produced by the two first double linkings. Aromatic compounds behave as if they contained tertiary carbon atoms, an observation which is in favour of Claus's formula.

The data for oxygen compounds require the assumption of different values for the susceptibility of oxygen according to its mode of combination. H. M. D.

Effect of Mechanical Vibration on Carbon Dioxide Near the Critical Temperature. II. Walter P. Bradley, Arthur W. Brown, and C. F. Hale (*Physical Review*, 1908, **26**, 470—482).—Further details are given of the production of fog in carbon dioxide under the conditions described in a previous paper (Abstr., 1905, ii, 75). A distinction is drawn between dynamic fog, which clears up at once when the vibrations are interrupted, and the more persistent residual fog, which clears away in part by settling. The sensitiveness of the system to vibrations depends greatly on the width of the tube, which must be at least 5 mm. in internal diameter, and on the temperature. When the carbon dioxide is in thermal equilibrium, residual fog practically cannot be produced below 30°; the system is most sensitive at 31·1—31·2°, and above the latter temperature the sensitiveness diminishes rapidly. The critical temperature is 31·26°.

The effect of rising and falling temperature on the fog has been investigated. Minute changes of temperature were brought about by sudden slight alteration of the volume of the carbon dioxide, as well as by the slower method of changing the temperature of the bath. When the temperature is very near the critical and the gas is slightly compressed, new liquid is after a time formed, and this is at first not allied in sensitiveness to the liquid existing previously, but to what remains of the vapour phase. Under equilibrium conditions, fog tends to thicken towards the meniscus, and the phenomena may be used to define the boundary between phases when the meniscus is no longer visible. G. S.

Liquid above the Critical Temperature. Walter P. Bradley, Arthur W. Browne, and C. F. Hale (*Physical Review*, 1908, 27, 90—106).—When carbon dioxide is progressively compressed in a Cailletet apparatus just below the critical temperature, at a certain point liquid begins to run down the glass, forming "ripples," which adhere to the wall until they reach the level of the meniscus, when they leave the wall and mix with the remainder of the liquid. The same phenomenon may, however, be observed above the critical point, even up to 38°, the ripples run down the glass for some distance, and then spread out as though they had reached a "liquid" and were mixing with it. An increase in the volume of this localised "liquid" results, above the critical temperature, in ripples or striæ, which flow upwards, without any tendency to adhere to the glass, until they reach the localised vapour. Below the critical temperature, these ripples are replaced by bubbles, rising to the meniscus. For these and other reasons, it is considered that liquid exists above the critical temperature.

The paper concludes with a discussion of the nature of the critical state. G. S.

Examination of the Laws of Radiation of the Bunsen Flame. Hans Schmidt (*Ann. Physik*, 1909, [iv], 29, 971—1028).—It has been found that the radiation of a Bunsen flame, investigated for the bands at 2·7μ and 4·4μ, is determined by the same quantitative laws which regulate the radiation of a black body. Although it is not possible to conclude from this that the radiation is a pure temperature effect, the author supposes that, although the origin of the radiation is a luminescence phenomenon, the intensity is determined by the temperature of the surrounding medium.

The mean temperature of the Bunsen flame, examined by the author at a height of 2·5 cm. above the mouth of the burner, was found to be 1670°. H. M. D.

The Specific Heats of Argon, Steam, Nitrogen, and Hydrogen at Very High Temperatures. Mathias Pier (*Zeitsch. Elektrochem.*, 1909, 15, 536—540).—Electrolytic gas, mixed with one of the other gases, was exploded in a spherical bomb of 35 litres content, and the pressure measured by means of a corrugated steel diaphragm fixed in the side of the bomb. The maximum movement of the centre of the diaphragm was about 0·8 mm.; this was transmitted by a lever to a silver mirror, from which a spot of light was reflected on to a rapidly moving photographic film. In this way the rise and subsequent fall of pressure due to the explosion and cooling of the gases is registered. The moving parts of the manometer weighed less than 1 gram, and the curves obtained showed a sharp maximum and were free from the waves due to the inertia of the manometer which previous observers have obtained. The mean molecular heats of the gases between 0° and t° found are:

Steam	$6{\cdot}065+0{\cdot}0005t+0{\cdot}2\times10^{-9}t^3$
Argon	$2{\cdot}977$
Nitrogen	$4{\cdot}900+0{\cdot}00045t$
Hydrogen	$4{\cdot}700+0{\cdot}00045t$

These formulæ hold good for values of t lying between 1300° and 2500°. The close agreement between the value found for argon and the theoretical value is regarded as proving the accuracy of the results.

T. E.

Calorimetric and Cryoscopic Constants of Mercuric Bromide. Joseph Guinchant (*Compt. rend.*, 1909, **149**, 479—481. Compare Abstr., 1907, ii, 667; Beckmann, *loc. cit.*, 739).—Mercuric bromide melts at 235° and has a latent heat of fusion (L) of 12·8 cal. The solid has specific heat 0·052, and the liquid, 0·068. Application of van't Hoff's formula, $K = 0{\cdot}0198T^2/L$, gives the value 403 for the cryoscopic constant of mercuric bromide, where T is the absolute melting point. Experimental determinations of the cryoscopic constant with various solutes show a decrease in the value obtained as the concentration of the solutions increased. The author therefore calculates the limiting value of the cryoscopic constant for infinitely dilute solutions. The results obtained are: β-dibromonaphthalene 407, anthraquinone 380, mercurous bromide, Hg_2Br_2, 378, antimony bromide, $SbBr_3$, 350, ammonium bromide 345, potassium bromide 323, silver bromide 320, thallium bromide 283. Bromides of lead, lithium, sodium, and calcium are insoluble in fused mercuric bromide. Solutions of mercurous bromide in mercuric bromide are anomalous, for as the concentration of the solutions increases, the cryoscopic constant increases. This is due to the formation of a cryohydrate containing 4·69% of mercurous bromide and melting at 231°. The increase of K from 378 at infinite dilution to 431 in a solution of 3·533% strength corresponds with a compound of formula $Hg_2Br_2,6HgBr_2$.

Since the experimental cryoscopic constant (mean 340) is markedly less than the theoretical (403), it is suggested that mercuric bromide, like benzene in some instances, does not completely separate the solute into single molecules.

R. J. C.

***cyclo*Hexane as a Cryoscopic Solvent: Behaviour of Piperidine.** Luigi Mascarelli and A. Constantino (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 104—111. Compare this vol., ii, 19).—In order to ascertain whether the abnormal depressions of the freezing point of *cyclo*hexane are due to the formation of solid solutions, the authors have made further experiments on the behaviour of piperidine in this solvent.

It is found that the cryoscopic behaviour of piperidine in *cyclo*hexane containing a small amount of *p*-dibromobenzene is similar to that exhibited in the pure solvent. Determinations were made of amounts of piperidine and *p*-dibromobenzene in the crystals separating from such solutions, the results indicating that solid solutions are formed between the *cyclo*hexane and piperidine; the results were, however, not sufficiently accurate to admit of conclusions being drawn concerning the concentrations of these solid solutions or the coefficients of distribution of the piperidine between the solid and liquid phases.

The freezing-point curve of the system piperidine–*cyclo*hexane consists of two branches meeting at a eutectic point at about −33°, at which the mixture contains 62·5% of piperidine.

The m. p. of piperidine is found to be $-13°$, the value usually given in text-books being $-17°$. T. H. P.

Latent Heat of Fusion and Specific Heat of Propionic Acid. Gustave Massol and A. Faucon (*Compt. rend.*, 1909, **149**, 345—348).—The acid which was used in the determination of the latent heat of fusion melted at $-19·8°$, and was kept for three hours at $-20°$ before the experiment. The mean value obtained was 23·35 Cal., whereas the numbers calculated from the formulæ of van't Hoff and de Forcrand are respectively 26·7 and 30·36 Cal. The latent heat is supposed to vary with the time which has elapsed since solidification took place.

The specific heat of solid propionic acid between $-46°$ and $-19·8°$ was found to be 0·728, which is very much greater than that of the iquid (0·535). H. M. D.

Modification of the Beckmann Apparatus by which Constant Readings are Obtained in Determining the Boiling Points of Aqueous Solutions. Edmund Knecht and J. P. Batey (*Mem. Manchester Phil. Soc.*, 1909, **53**, xix, 1—6).—Both Bigelow (Abstr., 900, ii, 9) and Beckmann (Abstr., 1908, ii, 633, 1014) have stated hat electric heating is not suitable for the ebullioscopic method for determining molecular weights in aqueous solution owing to the lectrolysis which takes place. These investigators used a heating coil f 5 ohms resistance, the drop in potential across the coil being from ½ to 10 volts.

The authors find that the electrical method of heating is quite satisactory, even with aqueous solutions, when a heating coil of low reistance is used. In their apparatus the resistance of the coil at 100° is 0·47 ohms, and the drop in potential across the coil in order to btain a heating current of 6·5 amperes is only 3 volts. Experiments which were made on solutions of potassium chloride and iodide showed hat the amount of electrolysis was negligible.

Measurements of the molecular elevations of the boiling point of several electrolytes and non-electrolytes gave results which agreed with those obtained by other observers by the usual method.

T. S. P.

Vapour Pressure of Ice. Max Thiesen (*Ann. Physik*, 1909, v], **29**, 1057—1062).—The data obtained by Scheel and Heuse (this ol., ii, 643) for the vapour pressure of ice can be satisfactorily epresented by the formula: $\log. p/p_0 = 9·632(1 - 0·00035t).t/T$, or by g.$p/p_0 = 8·891.t/252 + t$. In these equations, t and T represent temeratures measured respectively from 0° and absolute zero, and p_0 and the vapour pressures of ice at 0° and $t°$. H. M. D.

Isotherms of Monatomic Gases and their Binary Mixtures. III. Data Concerning Neon and Helium. . Kamerlingh Onnes (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 2, 175—178).—By cooling with liquid hydrogen, neon was condensed a tube connected with a manometer. The liquid hydrogen was then removed, and the temperature of the experimental tube graduall allowed to rise, the pressure at which the meniscus disappeared being noted. In this way it was found that the triple-point pressure wa 35 cm., and the critical pressure 29 atmospheres.

In a somewhat similar manner the critical pressure of helium wa found to be 2·75 atmospheres. During these experiments the vapou pressure of the liquid helium was lowered to 2·2 mm., and a temperature reached which was estimated to lie below 2·5° abs.; this is th lowest temperature which has hitherto been attained. Even at thi low pressure and temperature the helium remains a light mobil liquid. T. S. P.

Condition of Substances in Solution in Absolute Sulphuri Acid. III. and IV. Giuseppe Oddo and E. Scandolo (*Gazzetta*, 1909, **39**, ii, 1—21, 44—47. Compare this vol., ii, 377).—The author have investigated the cryoscopic behaviour of solutions of alcohols o various types dissolved in absolute sulphuric acid, special care bein taken to avoid the presence of traces of sulphur trioxide in the aci employed.

The normal primary alcohols, methyl, ethyl, propyl, butyl, heptyl, and octyl, exhibit uniform behaviour, the molecular weights in absolute sulphuric acid being 36—38% of the theoretical values. Thes results, and also those obtained from a qualitative study of the solutions, show that, when these alcohols dissolve in sulphuric acid, th reaction taking place is expressed solely by the equation: $SO_2(OH)_2 + R\cdot[CH_2]_n\cdot OH = OH\cdot SO_2\cdot O\cdot[CH_2]_n\cdot R + H_2O$, according to which th molecular weight of the alcohol in the solution should be 37% of th calculated value. Whether the above reaction takes place directl or by way of the intermediate additive compound,

$$R\cdot[CH_2]_n\cdot O\cdot SO(OH)_3,$$

cannot be determined from the cryoscopic data.

Primary alcohols with a side-chain behave dissimilarly. The molecular weight of *iso*butyl alcohol in absolute sulphuric acid is 42—44% that of active amyl alcohol, 44—46%, and that of *iso*amyl alcoho 36—38% of the theoretical values. The influence of the side-chai hence depends on its complexity and on its position in the molecul If it starts from the γ-carbon atom and is not complicated, the behaviou of the alcohol differs but little, if at all, from that of the normal primar alcohols. If, however, the branching takes place at the β-carbon atom elimination of unsaturated hydrocarbon according to the equatio $SO_3H\cdot O\cdot CH_2\cdot CHRR' = H_2SO_4 + CH_2{:}CRR'$ soon commences, suc elimination increasing in rapidity with the complexity of R and R′. Should these hydrocarbons remain in solution and not be ionised, they would not cause the molecular weight to change from 37% o the theoretical value; it is therefore supposed that they separate i small, transparent drops, possibly in a colloidal condition, the molecula weight increasing with the abundance of such separation.

The molecular weights of secondary alcohols in absolute sulphuri acid are for *iso*propyl, 37—39%; for butyl, 47—49%; for octyl,

$$CH_3\cdot[CH_2]_5\cdot CHMe\cdot OH,$$

42—44%, and for menthol, 35—37% of the theoretical values. Othe actors besides the secondary nature and the branching are here at work.

Of the three tertiary alcohols examined, trimethylcarbinol and imethylethylcarbinol give molecular weights equal to 48—50% of the heoretical values in freezing absolute sulphuric acid. These high alues are related to the prompt elimination of the unsaturated hydro-arbon, as is indicated by qualitative study of the solutions. Triphenyl-arbinol, however, gives a molecular weight 25—27% of the calculated alue. Like all alcohols, triphenylcarbinol in absolute sulphuric acid mmediately gives rise to the corresponding ester, which, in this case, cts as a true salt, not of the oxonium, but of the triphenylcarbon ype. The theoretical molecular weight under such conditions should e 27·27% of the calculated value.

In the fourth part of this paper, the authors give the results of a tudy of the nature of the oil separating from a solution of *iso*butyl lcohol in absolute sulphuric acid. Except for a small inseparable raction, the oil is non-oxygenated, and consists entirely of hydro-arbons of the paraffin series, being very similar in its properties to merican petroleum. The mechanism of the formation of these ydrocarbons is as follows. By elimination of water, the alcohol gives ise to the corresponding unsaturated hydrocarbon, which then forms arious polymerides. In contact with sulphuric acid, the latter are artly oxidised and partly reduced to the saturated hydrocarbon, hich separates, whilst the sulphuric acid is reduced to sulphurous cid and ultimately to sulphur.

Hantzsch's work (Abstr., 1908, ii, 14, 462; this vol., ii, 18) is iticised. T. H. P.

Simplified Method and Apparatus for Determining the alorific Power of Combustible Gases. Paul Lemoult (*Compt. nd.*, 1909, **149**, 454—456).—The combustion of equal volumes of ydrogen and carbon monoxide, according to the equations: $H_2 + O =$ $_2O + 69$ Cal., $CO + O = CO_2 + 68·2$ Cal., if carried out in presence of kali, gives rise to the same contraction and requires the same lume of oxygen. As the heats of combustion of these two gases e practically equal to 68·6 Cal., for calorimetric purposes hydrogen d carbon monoxide may be considered together. If only hydrogen d carbon monoxide are present, taking a as the contraction on mbustion and b as the volume of oxygen required relative to the iginal volume of gas, the calorific value per litre will be given by $= 2·049a$ or $P = 6·147b$, subject to correction for temperature and essure. If besides hydrogen and carbon monoxide other combustible ses are present, a will not be equal to $3b$. In the usual case where ethane is present in quantity, taking its heat of combustion as 3·2 Cal., it easily follows that $P = (0·914a + 3·405b)$. When no ethane is present, a is equal to $3b$, and this equation reduces to e one given above.

The author shows that the presence of ethylene, benzene, acetylene, ., in the usual small proportions, introduces an error which cannot ceed 2%, that is, of the same order as the experimental error in most lorimeters. The estimation of calorific power by the author's method, which requires as data only the volume of oxygen used and the contraction in volume on combustion in presence of alkali, can be carried out in a simple portable apparatus. By this means the calorific value of the town gas at Lille was found to be 497·8 and 500·7 Cal. per litre, whereas the Berthelot bomb calorimeter gave 503·2 Cal.

R. J. C.

Thermochemistry of Nitrous Acid. W. SVENTOSLAVSKY [in part, with S. TSCHEGOLEFF, SKRJISCHEVSKY, W. OSSMULSKY, and S. GERICH] (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 587—641).—The author has studied, by the methods previously employed (this vol., ii, 23, 213, 547), the heats of solution, neutralisation, and decomposition of nitrous acid and the action of nitrous acid on phenols, tertiary aromatic amines, secondary amines, primary aromatic amines, carbamide, and hydroxylamine. The results confirm many of the conclusions previously drawn (*loc. cit.*), such as the general law of the increase of the heat of formation of an atomic linking as the molecular weight of the compound increases. The following points are also brought out by the numbers obtained.

The thermochemical characters of the linkings of hydroxylamine and nitrous acid, and thermal investigation of the reaction of the former with quinones and of the latter with phenols, show that the heat of transformation of nitrosophenol into quinoneoxime is nil.

The complete analogy found to exist between nitrosophenols and tertiary aromatic nitrosoamines indicates that the nitroso-group functions in both classes of compounds, and weighs against the quinonoid formula for them.

T. H. P.

Heat of Formation of Cuprous and Cupric Sulphides. H. VON WARTENBERG (*Zeitsch. physikal. Chem.*, 1909, **67**, 446—453).—According to Thomsen, cuprous sulphide combines with sulphur to form cupric sulphide without absorption or development of heat, but as this statement is in conflict with other observations, the heats of formation of the two sulphides have been determined by bringing about the combination of the dry elements in a modified form of calorimeter. The results are as follows: $2Cu + S_a = Cu_2S_{cryst.} + 19 \cdot 0$ Cal.; $2Cu + 2S_a = 2CuS_{cryst} + 23 \cdot 2$ Cal. (S_a = rhombic sulphur). Hence a little heat is given out when cupric sulphide is formed from cuprous sulphide and sulphur. Cupric sulphide can be formed by direct combination only within narrow limits of temperature; at lower temperatures the rate of formation is too small, and at higher temperatures its dissociation pressure exceeds one atmosphere.

G. S.

Density of Mixtures of Water and Ethyl Alcohol. F. SCHWERS (*Rec. trav. chim.*, 1909, **28**, 261—266).—The densities of mixtures of water and ethyl alcohol at temperatures between 0° and 30° have been determined by Mendeléeff (*Ann. Phys. Chem.*, 1869, [ii], 138). The author has determined the densities of mixtures containing from 4·99% to 93·55% of alcohol at temperatures varying from 14·6° to 74·2° by the method previously employed for mixtures of glycol and glycerol with water (this vol., i, 80). The composition of the various mixtures studied was determined by reference to Mendeléeff's results, after determining their density at a low temperature. The results are given in tabular form, and the variation of the contraction (on mixing) with the temperature is plotted in a series of curves. The observation of Kopp, that this contraction diminishes as the temperature increases for all mixtures containing more than 16·5% of alcohol, and increases with the temperature for mixtures containing less than 16·5%, whilst for the mixture containing 16·5% it is constant, is confirmed. In addition, the author observes that between 55° and 65° the contraction of all the mixtures, except that containing 16·5% of alcohol, ceases to vary for a certain small alteration in temperature, this phenomenon being exhibited by a slight flattening of the curves at this point. This point of inflexion is less marked than in mixtures of glycol and water, and still less than in the glycerol-water mixtures. E. H.

Is there Contraction when Sucrose is Dissolved in Water? R. Olizy (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 27, 60—69).—Sucrose and water are placed separately in a closed vessel, and the pressure of the air in the vessel carefully determined. When solution takes place, the pressure remains unaltered, showing that there is no change of volume when sucrose dissolves in water. The density of dissolved sucrose, calculated from the density of solutions, is 1·612 at 15°, in exact agreement with the value for solid sucrose given by Kopp. The relation between the density, *d*, and concentration of sugar solutions is accurately represented by the formula $100(d^{15}_{4} - 1) = 0{\cdot}37965s$, where s is the number of grams of sucrose per 100 c.c. of the solution at 15°. G. S.

Change of Density of Liquid Systems during Chemical Reactions. Alfred Benrath (*Zeitsch. physikal. Chem.*, 1909, 67, 501—511).—It is shown by experiments on the hydrolysis of sucrose and on the formation and decomposition of esters that the rate of some reactions can be followed by measuring the change of density, the latter being proportional to the change of concentration of the reacting substances. A reaction proceeds with expansion or contraction according as the number of dissolved molecules diminishes or increases. Increase of the external pressure, and the addition of indifferent substances which increase the internal pressure, accelerate reactions accompanied by contraction, and retard those attended by expansion. G. S.

Adsorption of Gold by Charcoal from Aqueous Solutions of its Salts. S. Brussow (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 137—138).—The different kinds of charcoal used were: (1) bone charcoal, either dried at 110° or undried; (2) wood charcoal, in the form of powder; (3) coke of the ordinary commercial variety; (4) retort carbon. The adsorption of the gold was observed either by shaking the charcoal with the solution of the gold salt, or by filtering the gold solution through the charcoal, or else by simply immersing the charcoal in the solution. The gold solutions varied in strength from 0·000045 to 0·002 gram $AuCl_3$ per 1 c.c. of solution.

In all cases the gold was completely withdrawn from the solution, the chlorine being left behind. Salts, such as sodium chloride, magnesium sulphate, magnesium chloride, calcium sulphate, and potassium hydrogen carbonate, did not affect the adsorption.

Solutions of the bromide and iodide of gold and of potassium aurous cyanide behaved similarly to the solution of gold chloride. T. S. P.

Some Colour Demonstrations of the Dissociating Action of Water. Robert L. Taylor (*Mem. Manchester Phil. Soc.*, 1909, **53**, [xviii], 1—3).—A recapitulation of some of the applications of the dissociation theory to the explanation of the colour of various salts, for example, copper sulphate, ferric thiocyanate, and potassium permanganate, in aqueous solution. T. S. P.

Intervention of Osmotic Pressure in Dyeing. Daniel A. Rosenstiehl (*Compt. rend.*, 1909, **149**, 396—399).—The author advances reasons which lead him to suppose that the action of dyes is due to physical cohesion between the fabric and the colouring matter, and that intimate contact between the two is brought about through the intervention of osmotic pressure. W. O. W.

Osmotic Pressure of Complex Solutions. Alexander A. Jakowkin (*Zeitsch. physikal. Chem.*, 1909, **67**, 309—320. Compare Abstr., 1901, ii, 87).—As complex solution the comparatively simple case of one solute in a mixture of two solvents is considered. It is shown theoretically that the complex solvent is in osmotic equilibrium with the complex solution when the ratio of the "molecular roots" of the vapour pressures of the components of the solvent ($\sqrt[m]{p}$, where m is the molecular weight) is the same for the two phases.

To test the theory, the partial pressures of the two components in a mixture of the ether of ethyleneglycol and water (the complex solvent) and in solutions of glycerol (a non-volatile solute) in the complex solvent have been determined at 50° (compare Makovetski, Abstr., 1908, i, 753). A mixture containing 36·8% of glycerol and the water and the ether in varying proportions was used. The osmotic pressure, calculated from the observations according to the formulæ deduced, is about 1·5 times the gas pressure in water alone, and in mixtures containing up to 20% by weight of the ether, but diminishes to about one-sixth of the gas pressure when the solution contains 60 mol.% of the ether. G. S.

Piezochemical Studies. II. Influence of Pressure on Solubility. Ernst Cohen and L. R. Sinnige (*Zeitsch. physikal. Chem.*, 1909, **67**, 432—445. Compare this vol., ii, 291, 641).—An arrangement by which solubilities under high pressures may be accurately determined is figured and described in detail. The apparatus is provided with an electro-magnetic stirrer, and the temperature is measured with a platinum resistance thermometer. The solubility of $CdSO_4,\frac{8}{3}H_2O$, expressed as the number of grams of anhydrous salt in 100 grams of water at 25° under different pressures, is as follows:

76·80 at 1 atmosphere, 78·00 at 500 atmospheres, 78·72 at 1000 atmospheres. For $ZnSO_4,7H_2O$ at 25°, 57·95 grams anhydrous salt at 1 atmosphere, 57·91 grams at 500 atmospheres, 57·55 grams at 1000 atmospheres. G. S.

Formation of Solid Surfaces on Liquids. G. Nagel (*Ann. Physik*, 1909, [iv], 29, 1029—1056).—It is shown that the formation of solid layers at the surface of solutions is a phenomenon of frequent occurrence. For different types of solutions, such as solutions of dyes, metallic salts, and colloidal metals, it has been found that this is due to the separation of insoluble substances at the surface, and that these are either present in the form of very fine suspensions in the liquid or are the result of chemical changes at the surface of the liquid.

In the special case of an aqueous solution of magenta, which was examined in detail, the experiments show that the formation of the surface layer is not influenced by the surrounding air, and that the substance in the solid layer is insoluble in water.

From observations on the thinnest surface layers formed in solutions of cobalt chloride, $6\mu\mu$ is deduced as the upper limiting value for the radius of the sphere of molecular action. H. M. D.

Reciprocal Action of Substances in Solution. Eugen von Biron (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 569—586).—In considering the actions which substances in solution exert one on the other, the author makes the two following assumptions: (1) That pairs of liquids exist which are soluble in one another in all proportions, and retain, in the solutions so formed, their original properties absolutely unchanged. To the property of forming such solutions he gives the name *isofluidism.* (2) That all possible solutions represent in their properties a series continuous from the most simple, formed by isofluidic substances, to the most complex, which exhibit distinct chemical action between the components.

Isofluidic substances should form solutions without either expansion or contraction, the specific volume being a linear function and the density a hyperbolic function of the proportion of one of the two constituents.

The author has measured the deviations from these simple relations exhibited by solutions in varying proportions of ethyl iodide and ethyl acetate; benzene and ethyl chloride; chlorobenzene and bromobenzene; benzene and chlorobenzene; benzene and bromobenzene; benzene and toluene; toluene and chlorobenzene; toluene and bromobenzene; benzene and carbon tetrachloride; chloroform and carbon tetrachloride; ethylene dichloride and ethylene dibromide; carbon tetrachloride and chlorobenzene; carbon tetrachloride and bromobenzene; ethyl acetate and ethyl formate; ethyl acetate and methyl acetate, and methyl acetate and ethyl formate. Tables are given showing in each case (1) the difference, δ, between the observed, D_H, and calculated contractions, D_B, and (2) the contraction constant, K, defined by the equation: $D_B = K.m_1m_2$, where m_1 and m_2 are the molecular percentages of the two constituents in the solution.

For the volume of 1 mol. of the solution, the author deduces an expression of the form : $A + Bx + Cx^2$, where x is the content of one of the components in the solution, and A, B, and C constants for the given pair of substances. This expression shows that the contraction is a maximum for the solution containing the two components in equal molecular proportions, the amount of the contraction diminishing symmetrically to zero for each of the pure constituents.

The author is of opinion that the contraction is not the result of chemical action between the component liquids, but rather of a physico-mechanical action. For not only is it difficult to imagine compounds such as benzene and toluene uniting to form a chemical compound, but it is improbable that, with liquids of such varying chemical functions as those examined by the author, such compounds should always be formed from the two components in equimolecular proportions. T. H. P.

Crystallisation from Aqueous Solutions. II. Robert Marc (*Zeitsch. physikal. Chem.*, 1909, 67, 470—500. Compare Abstr., 1908, ii, 160).—The experiments were made by the method already described, except that the rate of crystallisation was determined by measuring the variation in the conductivity of the supersaturated solution ; a special apparatus for this purpose is described. Measurements have been made with potassium sulphate and dichromate, potassium and ammonium alum and silver acetate, and in all cases the rate of crystallisation is proportional to the square of the supersaturation. The temperature-coefficient between 0° and 10° is 1·5—1·6 in all the cases investigated. The velocity with which different substances crystallise in equivalent circumstances is not the same. The velocity of dissolution is, under equivalent conditions, always greater than the velocity of crystallisation, a result which appears to be incompatible with Nernst's view that a crystal is surrounded by a layer of saturated solution. When crystals are added to a supersaturated solution, the concentration of the solution diminishes very rapidly within the first half-minute, apparently owing to adsorption, and a correction has therefore to be applied to the constants calculated for a reaction of the second order. This rapid change during the first interval is approximately proportional to the concentration of the solution.

G. S.

Relation between the Density and Crystallographic Constants in Certain Groups of Substances. Luigi Colomba (*Atti. R. Accad. Sci. Torino*, 1909, 44, 684—698. Compare this vol., ii, 560).—The author applies the principles previously expounded to certain groups of substances, for which certain modifications are necessitated.

The first substances considered are those which contain constituents unknown in the free state. For example, magnetite, ilmenite, and bixbyite contain ferrous oxide. The value for this oxide of the hypothetical molecular volume necessary for determining the value of v'' in Σv^n is arrived at by applying to magnetite the equation corresponding with the spinel group (*loc. cit.*). The number, 11·42 (D 6·29), thus found for the molecular volume of ferrous oxide agrees fairly well with the value, 11·76 (D 6·13), similarly obtained from ilmenite (ferrous titanate). Taking the mean of these two values, the calculated densities for magnetite, ilmenite, and bixbyite ($FeMnO_3$) are 5·13, 4·73, and 5·19, the experimental numbers being 5·15, 4·72 and 4·95 respectively; the indifferent agreement in the case of bixbyite is due to the presence of SiO_2,MgO and Al_2O_3, which lower the density. Similar differences caused by impurities are found for hercynite and chromite, whilst for the various members of the granite group, differences are found owing to the replacement of certain of the oxides present by others in varying amounts.

The following cases are also discussed: (1) the rhombohedral carbonates, with which it is necessary to ascertain a hypothetical value for the molecular volume of carbon dioxide in the crystalline state; (2) the mercury compounds, cinnabar, metacinnabarite, and tiemannite; (3) substances which may be regarded as additive products, characterised by the fact that the components and the additive product are all of the same crystallographic type, such as pentlandite and chalcopyrite; (4) pyrites, hauerite, and laurite, for which concordant results are obtained by taking the value 15·61 (D 2·06) for the atomic volume of sulphur instead of 16·41, and (5) sperrylite ($PtAs_2$) and skutterudite ($CoAs_3$), in which no such modification of the atomic volume of arsenic is necessary; (6) cobaltite, gersdorffite, and ulmannite, for which the index of deformation is 1·36, 1·34, and 1·34 respectively; regarding these compounds as additive products of a disulphide with a diarsenide or a diantimonide, their index of deformation should be 1·343, the mean of the values 1·612 and 1·0746 (*loc. cit.*). T. H. P.

Influence of Impurities on the Lower Limits of Crystallisation. Maurice Padoa and L. Mervini (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 58—63).—The author has measured the crystallisation velocities and lower limits of crystallisation for (1) triphenylmethane mixed with benzophenone, aniline, apiole, or α-naphthylamine; (2) diacetylcotoin mixed with benzophenone, bromonitrobenzene, apiole, or amyl alcohol; (3) salipyrine mixed with benzophenone or bromonitrobenzene (compare Bogojawlensky, Abstr., 1899, ii, 206).

The results obtained show that the addition of one substance to another always produces a lowering of the inferior temperature limit of crystallisation. In most cases, this inferior limit remains constant while the concentration of the added substance varies within wide limits, although in some instances it is continually lowered by fresh addition. T. H. P.

Experiments and Models in Illustration of Liquid Crystals. Otto Lehmann (*Physikal. Zeitsch.*, 1909, 10, 553—560).—The author describes thirty-two experiments which are designed to illustrate the nature and properties of liquid crystals, and to show the relationships between solid and liquid crystals.

If the orientating forces in the molecules are magnetic forces, the molecules of liquid crystals must represent astatic magnetic systems.

Models of such astatic systems built up from horse-shoe magnets are described and illustrated. H. M. D.

Vapour Pressure of the Granules of Solid Substances. P. N. Pawloff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 679—684).—The author has investigated the relation between the vapour pressure and size of solid granules by placing small granules of various substances in closed chambers, and observing from time to time the changes in their magnitudes, the temperature of the surrounding air being 13—15°. The compounds examined were diphenylmethane, triphenylmethane, iodoform, dibenzyl, menthol, salol, guaiacol, and azoxyphenetole.

In the case of diphenylmethane, for example, the granules employed were, at the least, 2μ in diameter. In two days' time, these small granules diminished in number, and many as large as 30μ appeared. After six days, very few granules less than 7μ in size were found, and after a month, granules less than 14μ in diameter were rare. In part, the crystals were collected in heaps along the edges of the chamber, and all the crystals exhibited rounded angles.

Assuming that the pressure of saturated vapours follows the laws of ideal gases, the Clausius-Clapeyron equation for the evaporation of solids leads to the expression $d(\log.p)/dT = Q/2T^2$, where p is the pressure of the saturated vapour, Q the molecular heat of evaporation, and T the absolute temperature. From this expression, the author deduces the equation $p_2\pi_1/\pi_2p_1<1$, where p_1 and p_2 are the vapour pressures of the finest granules, and π_1 and π_2 the vapour pressures of the coarse granules at two neighbouring temperatures, T_1 and T_2 ($T_2>T_1$). This inequality determines the course of the vapour pressure curves for the granules considered, and renders it evident that, in the general case, these curves will intersect. From the author's previous deductions (this vol., ii, 295), it follows that, if the free surface energy is independent of the radius of the granule, the vapour-pressure curves will meet at an infinite temperature. If, however, the free surface energy is a function of the granule-radius, the curves will meet at some finite temperature. The relations between the vapour-pressure curves for the liquid and for the small and large solid granules in these two cases are discussed. T. H. P.

Relations between the Surface Modifications of Solid Crystalline Substances. Nature of Liquid Crystals. P. N. Pawloff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 685—688).—The variations in the physico-chemical properties of solid granules of different magnitudes being explained by the unequal quantities of surface energy per unit mass of the granules, the author terms such granules surface modifications of solid consistency.

Corresponding with the two types of vapour-pressure curves (see preceding abstract), two classes of surface modifications may be distinguished. With substances of the first class, the point of intersection of the vapour-pressure curves lies above the m. p., so that the transformation of one surface modification into the other cannot be observed. Such substances the author terms monotropic with respect to the transformation of their surface modifications. All substances will be monotropic which exhibit direct change of the solid crystals into the isotropic liquid.

With substances of the second class, the vapour-pressure curves for the large and small granules meet at a temperature below that at which the substance is converted into isotropic liquid (m. p.), so that the surface modifications can, in this case, be converted one into the other at a temperature lower than the m. p. ; such substances are termed enantiotropic. Below this transformation temperature, the coarse-grained modification will be stable, whilst above it, the stable modification will consist of the smallest crystalline individuals capable of existence. This aggregate of small crystals will form a liquid phase, exhibiting surface tension and the other properties characteristic of liquids. To this class of enantiotropic substances must be referred that group of compounds which, on melting, are transformed into anisotropic liquids, that is, the so-called liquid crystals. The latter are hence not crystals, but consist of crystalline dust condensed to a liquid, in which, in some circumstauces, the separate individuals may be regularly orientated. T. H. P.

Composition of the Gases in Very Hot Flames. Fritz Haber and H. J. Hodsman (*Zeitsch. physikal. Chem.*, 1909, 67, 343—383).—In a previous paper, the equilibria in the flame of carbon monoxide burning in oxygen have been investigated by a special method (Haber and Le Rossignol, this vol., ii, 384), and from the results and the heat of combustion of the mixture, the temperature of the flame has been calculated (calorimetric method). The temperature of the flame has also been estimated from the above results, the known equilibria at lower temperatures, and the specific heats of the gases (thermodynamic method), but the results of the two methods are only in moderate agreement. In order to obtain further data, the above experiments have been repeated and extended. The results depend on the degree of moisture present in the flame. With moist carbon monoxide, results in good agreement with those already described were obtained, but when the oxygen is in excess and is still further increased, the value of $K=[CO_2]/[CO][O_2]^{\frac{1}{2}}$ increases continuously, and the difference between the calorimetric and thermodynamic values of the temperature becomes regularly greater. To account for these results, it is suggested that an endothermic product is formed from the oxygen in the flame; this may be ozone, oxygen atoms, or products of the electrolytic dissociation of oxygen. Ozone has been detected qualitatively in the flame. The equilibrium relations of ozone as a function of the temperature are discussed in detail.

Experiments have also been made with acetylene burning in oxygen; the method used in obtaining a suitable flame is described at length. The temperature of the flame is higher than that of carbon monoxide (over 3000° when the gases are in the theoretical ratio), and with excess of oxygen there is greater dissociation of carbon dioxide than in the carbon monoxide flame under corresponding conditions. The equilibrium, $H_2O \rightleftharpoons H_2+\frac{1}{2}O_2$, in the acetylene flame has also been investigated, and the results are in fair agreement with those of Nernst and Wartenberg.

The hydrogen-oxygen flame has been examined under the same conditions, but the method does not suffice to prevent recombination of the products during removal from the flame. Ozone and nitrous fumes can readily be detected in the hydrogen-oxygen flame a little above the inner cone, but attempts to detect hydrogen peroxide under these conditions have not led to very satisfactory results. The acetylene flame contained the largest proportion of nitrous fumes: under certain conditions as much as 4 volumes to 100 volumes of carbon dioxide.

It is considered that in gases above 2500°, electric dissociation plays a great part in the changes taking place. G. S.

Demonstration of the Phase Rule. Boulouch (*Compt. rend.*, 1909, **149**, 449—450. Compare Muller, Abstr., 1908, ii, 466).—The attempt made by Muller to deduce the phase rule without the aid of thermodynamics depends on the assumption that, when two phases are in equilibrium, equal quantities of an independent constituent are transferred in both directions across the surface of separation in a given period of time, these quantities being a function of the pressure, temperature, and composition of the phases. There is no evidence that the equilibrium between phases is of this mobile character, or, if it is, that pressure and temperature play any part. In the simple equilibrium between liquid and vapour, the reversible transference of matter from one phase to the other depends on volume alone. R. J. C.

The *P-T-X* Space Figure for a System of two Components which are Miscible in all Proportions in the Solid or Liquid Crystalline Phase. Andreas Smits (*Zeitsch. physikal. Chem.*, 1909, **67**, 464—469).—A theoretical paper in which a projected pressure-temperature composition space model for the system in question is constructed and certain deductions drawn. G. S.

Phenomena Occurring when the Plait-point Curve Meets the Three-phase Line of a Dissociating Binary Compound. Andreas Smits (*Zeitsch. physikal. Chem.*, 1909, **67**, 454—463).—A theoretical paper. Only cases are dealt with in which the compound is miscible with its components in all proportions in the liquid form. The results throw light on the phenomena occurring when compounds under high pressure are raised to such temperatures that critical phenomena occur in the case of saturated solutions.

G. S.

Dynamic Allotropy of Sulphur. The System Sulphur-Benzoic Acid. Hugo R. Kruyt (*Zeitsch. physikal. Chem.*, 1909, **67**, 321—342. Compare this vol., ii, 228).—The first part of the paper consists of a theoretical investigation of the isothermals of a pseudo-ternary system in which there is the possibility of the formation of three phases, the case in which equilibrium is attained, as well as that in which equilibrium is not attained, being considered. The theory is applied to explain the behaviour of the system sulphur–benzoic acid, the two components, besides the acid, being S_μ and S_λ. The fusing-point and miscibility curves of the system have been investigated in the usual way. Benzoic acid melts at 121·7°; at 118·5° the acid is in equilibrium with two liquid layers, and at 170° there is a three-phase equilibrium between three liquid layers, the phases containing 2·2%, 2·8%, and 82·6% of benzoic acid respectively.

G. S.

Saponification in Stages of the Esters of Dibasic Acids. II.

Julius Meyer (*Zeitsch. physikal. Chem.*, 1909, **67**, 257—308).—In a previous paper (this vol., ii, 391) the results of an investigation of the hydrolysis of the esters of dibasic acids in the presence of dilute hydrochloric acid were given; in the present paper the saponification by dilute alkali of the methyl and ethyl esters of malonic and succinic acids, of the methyl esters of camphoric acid, and of the acetic esters of glycol and glycerol is discussed. For the first group, the reactions proceed in the two stages: (1) di-ester + alkali ⟶ alkali salt of mono-ester + alcohol; (2) alkali salt of mono-ester + alkali ⟶ alkali salt of dibasic acid + alcohol, and in the first part of the paper formulæ are deduced which admit of the calculation of the constant of the first reaction when the experimental data for the latter and the constant for the second reaction are known.

The saponification of the two acetates of glycol by alkali is in both cases bimolecular, and the value of the velocity constant for the first reaction is double that of the second. Similarly, the data for the saponification of the three glycerol acetates are also well represented by the equation for a bimolecular reaction; the velocity constants for the successive stages are in the ratio 3 : 2 : 1.

On the other hand, the reaction between the di-esters of dibasic acids and alkali is not bimolecular, and there is no simple relationship between the constants for the two stages of the reaction. At 25°, the first ester group of malonic acid is split off about 100 times, and for succinic acid about ten times, more rapidly than the second group. In both cases the methyl esters are saponified rather more rapidly than the ethyl esters.

Besides the above symmetrical esters, the *V* and *E* esters and the di-ester of camphoric acid have been saponified in a mixture of methyl alcohol and water at 35° and 45°. In this case there are four velocity constants, those of the *V* and *E* mono-esters, and the constants representing the velocity with which one group is split off from the di-ester, giving rise to the salts of the *V* and *E* mono-esters respectively. The reaction in the case of the mono-esters is bimolecular, and the ratio *E* : *V* is 38 : 1 at 35° and 53·4 : 1 at 45°. The saponification of the di-ester is very complicated.

The temperature-coefficients of the various reactions have been measured; in almost all cases the quotient for 10° lies between 2 and 3.

The results are interpreted according to the kinetic theory already discussed when dealing with hydrolysis in the presence of acids. The reason why there is no simple relationship between the constants for the two stages of the saponification of a symmetrical ester, such as malonic ester, is that the product formed in the first stage is a salt, for example, potassium ethyl malonate, which is highly ionised, and the anion $CO_2Et·CH_2·CO·O'$ is not readily acted on by the OH′ group, owing to the mutual repulsion of the negative charges. G. S.

Inorganic Chemistry.

Electrolytic Preparation of Hypochlorites. W. N. OGLOBLIN (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 670—679).—After reviewing previous work on the electrolysis of sodium chloride solutions, the author describes his own experiments on this subject, the results of which are briefly as follows.

Other conditions being constant, the greatest amount of active chlorine is obtained at the ordinary temperature from the most concentrated solution of sodium chloride. As the hypochlorite solutions formed are decomposed by the action of air and light, the greatest yield of active chlorine is obtained when the interruption of the current during electrolysis is least. The proportion of active chlorine increases with the period of electrolysis. The more the temperature rises in the electrolytic cell, the less is the yield of active chlorine. The greater the current employed, the greater will be the active chlorine obtained and the less the amounts of salt and current used. The loss of chlorine increases with the time of exposure of the solution to sunlight and air. T. H. P.

Caro's Acid. HERMANN AHRLE (*Zeitsch. angew. Chem.*, 1909, **22**, 1713—1715).—An improved form of apparatus (compare this vol., ii, 395) is described, by means of which anhydrous sulphur trioxide and hydrogen peroxide may be quantitatively mixed in any desired proportion and the resulting mixture analysed. If hydrogen peroxide is slowly added drop by drop to sulphur trioxide, Caro's acid is first formed and then transformed by the excess of sulphur trioxide into persulphuric acid, $H_2S_2O_8$. On the other hand, if the sulphur trioxide is added to the hydrogen peroxide, persulphuric acid can seldom be detected. In experiments to determine the composition of Caro's acid, known weights of sulphur trioxide and hydrogen peroxide, the latter in excess, were mixed, and the resulting mixture analysed. The amounts of hydrogen peroxide and of Caro's acid were determined by means of permanganate and ferrous sulphate, and the amount of free sulphuric acid by means of a solution of acid barium phosphate. The results are in accordance with the formula H_2SO_5 for Caro's acid, and are not in agreement with the formula $H_2S_2O_9$. Towards phenolphthalein, Caro's acid behaves as a monobasic acid, only the H-atom of the OH group in the SO_2OH-residue being dissociated in aqueous solution (compare Price, Trans., 1906, **89**, 53). T. S. P.

Mixed Crystals of Sulphur and Tellurium. GIOVANNI PELLINI (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 19—24).—Sulphur and tellurium do not appear to unite to form a compound, but form a series of mixed crystals, which may be obtained both by fusion and from solution. Certain of these crystals are isomorphous with trimetric sulphur, those containing 0·557% of tellurium, obtained by the author, having the axial ratios $a:b:c = 0·81316:1:1·86929$, whilst for artificial sulphur crystals, the ratios are $a:b:c = 0·8108:1:1·9005$. A solid amorphous solution of tellurium and sulphur was obtained, which is insoluble in carbon disulphide. The red sulphur of Japan is probably an isomorphous mixture of sulphur, selenium, and tellurium. The position of tellurium in the sixth group of the periodic system is supported by the isomorphism of sulphur, selenium, and tellurium.

T. H. P.

Molecular Weight of Selenium in Solution. F. OLIVARI (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 94—100. Compare this vol., ii, 568).—Study of the solubility equilibrium between the components of mixtures of mercuric chloride with sulphur or selenium shows that the solubility of the components is not mutual, fused mercuric chloride dissolving sulphur and selenium, but not being appreciably dissolved by them. With tellurium and fused mercuric chloride, chemical action occurs to some extent, mercurous chloride being formed: $2HgCl_2 + Te = Hg_2Cl_2 + TeCl_2$.

Cryoscopic measurements of solutions of sulphur in fused mercuric chloride give normal results, corresponding with the formula S_8. With selenium, dilute solutions yield depressions of the freezing point, indicating that the selenium molecule varies between Se_8 and Se_4, the complexity of the molecule increasing with the concentration until it approaches Se_8. This complex molecule undergoes dissociation on dilution of the solution, and is less stable than the sulphur molecule S_8.

T. H. P.

Fusibility of Mixtures of Sulphur, Selenium, and Tellurium with Metals. HENRI PÉLABON (*Ann. Chim. Phys.*, 1909, [viii], 17, 526—566).—The author gives a connected account of his researches on the melting-point curves of mixtures of antimony, tin, silver, lead, thallium, arsenic, bismuth, and gold with sulphur, selenium, and tellurium, and the action of hydrogen on certain of the mixtures, from the point of view of the formation of compounds and eutectic mixtures (compare this vol., ii, 584).

The cryoscopic constant of tellurium lies between 510 and 535.

R. J. C.

Silicone. OTTO HÖNIGSCHMID (*Monatsh.*, 1909, 30, 509—525).—Silicone is the name given by Wöhler to the substance produced by the action of concentrated hydrochloric acid on calcium silicide, $CaSi_2$; the present investigation was undertaken with the object of establishing which of the two alternative formulæ suggested for this substance by Wöhler was correct. Analyses depending on the measurement of the hydrogen evolved by heating the substance in a vacuum agree with the formula $Si_3H_3O_2$; from the readiness with which hydrogen is evolved in these circumstances, it is concluded that this element is attached to silicon and not to the oxygen; the black residue which remains after the hydrogen has been driven off is probably a new suboxide of the formula Si_3O_2, analogous to carbon suboxide; it reacts at 400° with chlorine or hydrogen chloride to give silicon chloride, a little iron chloride, and pure white silicic acid.

The colourless substance, leucone, which is produced by exposing silicone to light and air, represents an intermediate step in the oxidation of silicone to silicon dioxide.

When heated in a vacuum, leucone evolves hydrogen, leaving a brown residue, which is probably a new oxide of the formula Si_3O_4.

P. H.

Inactive Gases and the Equation of State. HANS HAPPEL (*Ann. Physik*, 1909, [iv], 30, 175—181).—In reply to the criticisms of Rudorf (compare this vol., ii, 571), the author shows that his equation represents the behaviour of the inactive gases better than the ordinary form of the equation of state does, and maintains the correctness of his earlier views.

G. S.

The Electrolytic Separation of the Alkali Metals from Fused Alkali Hydroxides and the Solubility of the Metals in the Electrolyte. GEORG VON HEVESY (*Zeitsch. Elektrochem.*, 1909, 15, 529—536).—The solubility of sodium in fused sodium hydroxide is determined by heating a mixture of the two substances for from one to eighty hours in a thin brass (or at temperatures above 500°, nickel) tube, which is closed by a ground-in stopper and enclosed in a strong iron tube, also closed by a ground-in plug, which is held in position by a screw. After heating, the tube is immersed in cold water, which causes the sodium hydroxide to solidify without diminution of the quantity of sodium dissolved in it. The quantity of sodium taken up by the sodium hydroxide is independent of the excess of metal used; also a rich solution formed at a low temperature loses sodium at a higher temperature. The saturation values found (expressed in grams of sodium per 100 grams of sodium hydroxide) are: 480°, 25·3; 600°, 10·1; 610°, 9·9; 670°, 9·5; 760°, 7·9; 800°, 6·9. Below 480°, saturation is not attained in fifty hours.

The solubility of sodium alloyed with thallium, cadmium, and gold was also determined at 480°. The added metal is insoluble in fused sodium hydroxide, and it is found that the addition diminishes the solubility in proportion to the amount added. Further, taking the molecular weight of the metals dissolved in sodium as being proportional to the depression of the freezing point of the sodium, the lowering of the solubility of sodium is proportional to the number of dissolved molecules and independent of the nature of the metal. In accordance with this, it is found that zinc, which does not depress the freezing point of sodium, has no effect on its solubility in fused sodium hydroxide.

The solubility of potassium in fused potassium hydroxide is much smaller; the results obtained are: 480°, 7·8—8·9; 600°, 3—4; 650°, 2—2·7; 700°, 0·5—1·3.

Some experiments on the yields of sodium and potassium obtained in the electrolysis of the fused hydroxides (using an iron cathode surrounded by an inverted magnesia crucible which acts as a diaphragm) showed that in similar circumstances the yield of sodium is much less than that of potassium, and that it diminishes much more quickly as the temperature rises. It is shown that the sodium is not only more soluble, but that it diffuses through the fused hydroxide much more rapidly than potassium.

The addition of sodium chloride, bromide, or iodide to fused sodium hydroxide has no measurable effect on the solubility of sodium in it. T. E.

Action of Hydrogen on Sodium. Alfred Holt, jun. (*Mem. Manchester Phil. Soc.*, 1909, 53, xvii, 1—5).—When sodium is heated in an atmosphere of hydrogen at 270° for some days, the absorption of gas is small, and is accounted for by the formation of a film of the hydride. When heated in a current of hydrogen at about 400°, the sodium remains bright, but the hydride sublimes on to the cool portion of the tube. On allowing the sodium to cool, it becomes covered with a layer of hydride; on reheating, the film of hydride disappears at about 370°, only to reappear on the cooler parts of the tube.

When the pure sodium hydride is heated in a current of hydrogen, it decomposes at a temperature below that at which it begins to sublime, that is, decomposition of the hydride takes place at a lower temperature when heated alone than when it is present as a film on the surface of molten sodium.

At temperatures of 400—450°, the absorption of hydrogen by sodium is very small.

Moissan (Abstr., 1902, ii, 206) has shown that when sodium is heated to temperatures between 340° and 430° some hydride is formed, and remains dissolved in the molten metal, whereas Troost and Hautefeuille (this Journ., 1874, 767) found that at 380° sodium absorbed a volume of hydrogen, consistent with the formation of the compound Na_2H.

In the light of his own experiments, the author co-ordinates the results of Moissan and Troost and Hautefeuille as follows: When sodium is heated in a current of hydrogen at atmospheric pressure, combination begins at 270°, the hydride NaH being formed. This hydride dissolves in the excess of sodium; its vapour tension is thereby reduced, and hence none of it sublimes. With rise in temperature more hydride is formed, the ratio of sodium to hydride decreasing; hence the vapour tension of the hydride becomes greater, until at length it begins to sublime, this taking place at a temperature of about 380°. At this temperature the composition of the solution of the hydride in sodium corresponds with Troost's and Hautefeuille's compound, Na_2H or $NaH{\cdot}H$. Thus the formation of this easily dissociating compound is quite consistent with the sublimation of the compound NaH. T. S. P.

The Atomic Weight of Silver. GUSTAV D. HINRICHS (*Mon. Sci.*, 1909, [iv], 23, i, 383—388).—Richards' statements (this vol., ii, 231) in regard to the superiority of his determinations of the atomic weights of silver, chlorine, and nitrogen over those of Stas are discussed adversely by the author, who takes exception to the trustworthiness assumed. F. M. G. M.

Silicides of the Metals of the Alkaline Earths. OTTO HÖNIGSCHMID (*Monatsh.*, 1909, 30, 497—508).—The analysis of various samples of commercial silicides reveals the following facts. The product obtained by heating calcium with an excess of silicon consists of calcium silicide of the composition $CaSi_2$, mixed with a small quantity of iron silicide and excess of silicon; when treated with concentrated hydrochloric acid it yields yellow silicone (compare this vol., ii, 805); with dilute hydrochloric acid it yields hydrogen silicide together with partly decomposed yellow silicone. Another sample prepared by heating together calcium with silicon in the proportions required by the formula Ca_3Si_2 consists almost entirely of this substance together with traces of calcium carbide and iron silicide; with concentrated hydrochloric acid it yields a white silicon oxide and a quantity of spontaneously inflammable hydrogen silicide.

The samples of barium silicide examined were very impure, and contained in addition to the compound $BaSi_2$, 40% of iron silicide and 20% of silicon; when treated with dilute or concentrated hydrochloric acid, it yields hydrogen silicide together with a white silicon oxide, which is being further investigated.

Commercial magnesium silicide contains the compound Mg_2Si together with some free silicon and a little iron silicide. P. H.

Magnesium Peroxides. ORESTE CARRASCO (*Gazzetta*, 1909, 39, ii, 47—55).—The action of an ethereal solution of nearly anhydrous hydrogen peroxide on magnesium oxide yields the *compound*,

$$5MgO,2MgO_2,3H_2O,$$

which, by treatment with a further quantity of ethereal peroxide solution, is converted into the *compound*, $3MgO,2MgO_2,3H_2O$. Further treatment of the latter with ethereal peroxide solution results in the formation of the *compound*, $2MgO,2MgO_2,3H_2O$, which is stable at 30° and when gradually heated from 50° to 70° yields successively

$$3MgO,2MgO_2,3H_2O$$

and the *compound*, $4MgO,2MgO_2,3H_2O$.

These magnesium peroxides are obtained in the form of light, white powders, which decompose violently when heated, and are also decomposed by water.

The main cause of the difficulty of obtaining higher peroxides than Mg_2O_3 is the great tendency of the normal peroxide to form double compounds with magnesium oxide of the form

$$(MgO)_nH_2O,2Mg(OH)\cdot O_2H.$$

The action of an ethereal solution of hydrogen peroxide on a mixture of magnesium oxide and potassium chloride gives the *compound*, $KCl,MgO(OH)_2$, which is a moderately stable compound and evolves oxygen slowly when treated with water. The similar *com-*

pound, $MgCl_2,2MgO_2,Aq$, is extremely stable and hygroscopic. Compounds with potassium bromide and sodium chloride could not be obtained. T. H. P.

Magnesium Oxychlorides. O. KALLAUNER (*Chem. Zeit.*, 1909, 33, 871).—When Sorel's cement (a mixture of magnesia and magnesium chloride) is extracted with cold water, the whole of the magnesium chloride may be removed; a residue of constant composition is not obtained. Absolute alcohol extracts the whole of the chloride from mixtures with more than 40% of water and less than 24% of magnesium chloride. The weight does not become constant in a month's exposure over sulphuric acid, and at 130° hydrochloric acid begins to be evolved. The free magnesia present cannot be converted quantitatively into carbonate by carbon dioxide. The author thinks that the cement contains no definite oxychloride, but consists of a solid solution of magnesium hydroxide in magnesium chloride.

T. E.

Solutions of Colloidal Metals obtained by the Action of Boiling Distilled Water. II. MARGHERITA TRAUBE-MENGARINI and ALBERTO SCALA (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 111—116. Compare this vol., ii, 731).—The authors have made measurements of the amounts of platinum and silver dissolved in the colloidal state by distilled water under certain conditions.

When a bright strip of lead is immersed in distilled water, solution of the metal takes place almost immediately, the liquid becoming turbid and ultimately depositing a white, crystalline substance, the amount of which gradually increases. On the other hand, if the lead is immersed in a drinking water containing carbonates of the alkaline earths, no solution of the metal occurs for some time; the acid carbonates seem to form an insoluble compound with the lead, probably a double carbonate, which is deposited on the metal and protects it from further attack. When the immersion is prolonged, the metal dissolves.

Lead was also immersed in Mangiatorella water, which gives 0·694 gram of dry residue per litre (at 180°), consisting mainly of silica, calcium sulphate, calcium, sodium and potassium chlorides, calcium, magnesium and sodium hydrogen carbonates, dissolved carbon dioxide, oxygen, and nitrogen. No solution of the lead occurred, even when the supposed protecting layer was repeatedly removed by means of glass paper. T. H. P.

Decomposition of Copper Sulphate in a Current of Dry Air in Relation to the Temperature. W. VANJUKOFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 688—717).—The author has examined the behaviour of crystallised copper sulphate when heated at different temperatures in a glazed porcelain tube placed in a Heraeus furnace, the temperature being measured by means of a thermocouple connected with a galvanometer. The principal results obtained are as follows.

The decomposition of copper sulphate with evolution of the elements of sulphuric acid commences under the above conditions at 341°

(Bradford, *Trans. Amer. Inst. Mining Eng.*, 1902, 59, gave 653°). Within the temperature limits 341—653°, the movement of the galvanometer needle is arrested three times, at 380°, 503°, and 621°, which correspond with the formation of one and the same basic salt, $8CuO,3SO_3$, to the extents of 1·09, 2·38, and 5·87%. Between the limits 653—670°, an orange-yellow basic salt, $2CuO,SO_3$, is formed. Decomposition of this salt, with formation of cupric oxide, begins at 704° and is complete at 751°. But even at 850° copper sulphate is not completely decomposed, the residue always containing traces of sulphur.

When pentahydrated copper sulphate is heated in dry air, the hydrate, $CuSO_4,H_2O$, is formed at 93—99°, and the formation of anhydrous salt begins at 155° and is complete at 233°. At 180°, $4\frac{3}{4}H_2O$ is removed. T. H. P.

Double Fluorides of Quadrivalent Cerium. EBERHARD RIMBACH and HERMAN F. C. KILIAN (*Annalen*, 1909, 368, 101—109).—Only one double fluoride of cerium has been described hitherto, namely, the potassium cerium fluoride, $2CeF_4,3KF,2H_2O$ (compare Brauner, Abstr., 1882, 8). All attempts to prepare this salt, likewise the analogous lithium, sodium, rubidium, cæsium, and ammonium compounds, were, however, unsuccessful; in no case was a simple substance obtained, although the mean composition of the various samples of the potassium ceric fluoride which were prepared corresponded approximately with the above formula.

On the other hand, double salts of ceric fluoride with the fluorides of cadmium, copper, cobalt, nickel, and zinc having the general formula: $MF_2,2CeF_4,7H_2O$ are readily obtained in a pure state by treating a solution of ceric hydroxide in hydrofluoric acid with a solution of the metallic hydroxide in an excess of hydrofluoric acid. Manganese does not form a double fluoride under these conditions. The double fluorides are crystalline substances, and are decomposed more or less readily by water. The *zinc* and *cadmium* salts are white; the *copper* salt is pale blue; the *nickel* salt is apple-green; the *cobalt* salt is pale pink. W. H. G.

Cerous Salts of Organic Acids. EBERHARD RIMBACH and HERMAN F. C. KILIAN (*Annalen*, 1909, 368, 110—125. Compare Wolff, Abstr., 1905, ii, 457).—An account of the preparation and properties of cerous salts of certain organic acids. The normal salts are obtained by decomposing a solution of cerous nitrate with the neutral salt of the organic acid; the hydrogen salts are prepared by treating cerous carbonate with a solution of the acid. The solubility of the majority of the salts has been determined; the values recorded refer to the number of grams of the anhydrous salt present in one litre of the saturated solution at the stated temperature. It is shown that the composition of a mixture of fumaric and maleic acids may be determined with a fair degree of accuracy by making use of the different solubilities of the cerous salts.

Cerous malonate, $(C_3H_2O_4)_3Ce_2,6H_2O$, forms white crystals; sol. at 22·5° = 0·1606; the *hydrogen* salt, $(C_3H_2O_4)_3Ce_2,C_3H_4O_4,6H_2O$, crystallises in small, slender needles; sol. at 22·5° = 2·017. *Cerous glycollate*, $(C_2H_3O_3)_3Ce$, is a white, crystalline powder; sol. at 20° = 3·563. *Cerous malate*, $(C_4H_4O_5)_3Ce_2,8H_2O$, is an amorphous, white powder; sol. at 21° = 2·484; the *hydrogen* salt,

$$(C_4H_4O_5)_3Ce_2,C_4H_6O_5,6H_2O,$$

is a white powder; sol. at 22·5° = 11·58. *Cerous phthalate*,

$$(C_8H_4O_4)_3Ce_2,3H_2O,$$

is obtained by acting on a neutral cerous salt solution with potassium phthalate; it forms a white, microcrystalline powder. An analogous *salt* with $10H_2O$ is obtained by adding cerous carbonate to a solution of phthalic acid until it no longer dissolves, and then evaporating the solution; it forms stellate aggregates of needles; sol. at 23° = 2·945. The *hydrogen phthalate*, $(C_8H_4O_4)_3Ce_2,C_8H_6O_4,4H_2O$, crystallises in stellate groups of needles; sol. at 22·5° = 2·988. *Cerous maleate*, $(C_4H_2O_4)_3Ce_2,7H_2O$, forms white crystals; sol. at 18·5° = 2·238; the *hydrogen* salt, $(C_4H_2O_4)_3Ce_2,3C_4H_4O_4$, with $15H_2O$, forms small, white crystals, and with $16H_2O$ crystallises in large, faintly yellow plates, m. p. 83°; both of these salts dissolve readily in water. *Cerous fumarate* $(10H_2O)$ is a white powder; sol. at 20° = 0·117; the *hydrogen fumarate* $(2H_2O)$ is a lemon-yellow, crystalline powder; sol. at 18·5° = 0·243. *Cerous crotonate*, $(C_4H_5O_2)_3Ce,(C_4H_5O_2)_2Ce\cdot OH,11H_2O$, crystallises in tufts of soft, silky needles; sol. at 21° = 6·816.

W. H. G.

Solubility of Iron Oxide. Paul Rohland (*Zeitsch. anal. Chem.*, 1909, 48, 629).—A solution of calcium hydrogen carbonate slowly dissolves ferric oxide, and the velocity of the reaction may be much increased by addition of alkali sulphates or calcium sulphate.

It is not improbable that a temporary reduction of the ferric oxide takes place. The phenomenon may be explained by assuming that the HCO_3', HSO_4', and SO_4'' ions have a more powerful action when occurring simultaneously than when they occur alone; the action of the HSO_4' and SO_4'' ions is probably of a catalytic nature. L. de K.

Anhydrous Tungstates. Nicola Parravano (*Gazzetta*, 1909, 39, ii, 55—60).—The author has investigated the freezing-point diagram of the system Na_2WO_4–WO_3. Sodium tungstate melts at 698°, and at 588° and 564° undergoes two transformations, that at 564° being accompanied by the development of a considerable amount of heat, so that the temperature remains constant at this point for a considerable time. By addition of tungsten trioxide, the m. p. of sodium tungstate at first falls to the eutectic point, 626°, and then rises to the maximum, 731°, corresponding with $Na_2W_2O_7$. From 626° to 588° the mixtures between Na_2WO_4 and $Na_2W_2O_7$ are composed of α-Na_2WO_4 and $Na_2W_2O_7$; from 588° to 564° of β-Na_2WO_4 and $Na_2W_2O_7$, and below 564°, of γ-Na_2WO_4 and $Na_2W_2O_7$. The further course of the curve renders possible the existence of $Na_2W_5O_{16}$, but seems to exclude the tritungstate, $Na_2W_3O_{10}$. T. H. P.

Uranous Oxide. Wilhelm Oechsner de Coninck (*Bull. Acad. roy. Belg.*, 1909, 744—746).—Magnesium or aluminium in powder reduces uranyl chloride in aqueous solution, forming black uranous oxide. Mercury has no action on the chloride. The chloride may also be reduced by lime or barium hydroxide in the absence of air, but cupric oxide placed in a solution of uranyl chloride is converted into cupric chloride with a trace of copper uranate. T. A. H.

A Mode of Formation of Uranyl Nitrate. WILHELM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1909, 743—744).—On adding excess of silver nitrate to a solution of uranyl chloride and evaporating the filtrate to dryness, a mixture of uranyl nitrate, a red basic nitrate, and a double nitrate of uranyl and silver is obtained.

T. A. H.

Hydrolytic Decomposition of Bismuth Iodide. RENÉ DUBRISAY (*Compt. rend.*, 1909, **149**, 451—453. Compare this vol., ii, 742).—The addition of water to solutions of bismuth iodide gives a black precipitate, which turns brick-red when the concentration of bismuth in the liquid phase falls below 0·002 gram-atoms per litre. The curve representing the variation of bismuth with iodine in the liquid phase exhibits a discontinuity, whence it follows that the solid phase undergoes a transformation at this point, that is, that the red and black precipitates are two distinct *oxyiodides*. As the temperature is raised, the dissociation of bismuth iodide increases, but so long as only the black precipitate is present, the curves obtained are unbroken.

The brick-red oxyiodide, well washed with water but not dried, contains bismuth and iodine in the proportions to indicate the formula BiOI. The black oxyiodide, which could not be washed, was dried on a porous plate until it contained only 3% of mother liquor, and then gave analytical results indicating the formula $Bi_2O_3,5HI$ or $2BiOI,3HI,H_2O$. R. J. C.

Mineralogical Chemistry.

Danburite from Madagascar. ALFRED LACROIX (*Bull. Soc. franç. Min.*, 1908, **31**, 315—318).—Some rough, corroded crystals from Maharitra in the neighbourhood of Mt. Bity, with quite the appearance of yellow topaz, proved on examination to be danburite. Attached to them are fragments of lepidolite and rubellite, indicating that they had been derived from the pegmatite-veins. Analysis by F. Pisani gave:

SiO_2.	B_2O_3	Al_2O_3,Fe_2O_3.	CaO.	Total.	Sp. gr.
48·50	27·50	0·50	24·25	100·75	3·10

A gem-stone cut from this material also closely resembles topaz in appearance, from which it may be distinguished by its inferior hardness (H = 7) and D, but not by the refractive indices.

L. J. S.

Egyptian Minerals. J. Couyat (*Bull. Soc. franç. Min.*, 1908, 31, 341—349).—Various minerals are described, and analyses given of the following. Thenardite, as crystals reaching 4 cm. in length, occurring with halite and trona at the Natron lakes, gave on analysis :

SO_3.	Na_2O.	MgO.	Ca.	Cl.	Loss on ignition.	Total.
56·78	41·72	0·79	trace.	trace.	1·03	100·32

Peridot, occurring as crystals of gem quality in drusy cavities in an altered dunite (serpentine) on St. John's Island in the Red Sea. The cavities also contain nepouite. Peridot is the only fresh mineral present, and it is presumably of later formation. Analysis gave :

SiO_2.	MgO.	FeO.	MnO + NiO.	Al_2O_3.	Loss on ignition.	Total
41·3	48·9	9·0	0·8	nil	0·15	100·15

L. J. S.

Radioactive Minerals from Madagascar. Alfred Lacroix (*Bull. Soc. franç. Min.*, 1908, 31, 312—314).—Hatchettolite and autunite have already been described (this vol., ii, 58), and the following species are now recorded. Euxenite (?), as a single, indistinct crystal found in a specimen of pegmatite from Mt. Bandahély in the north of the island ; the material is blackish-brown, optically isotropic, and contains uranium. Fergusonite, a massive fragment, probably from pegmatite, found between Tamatave and Béforona ; it is optically isotropic, D 5·58. Analysis by F. Pisani gave :

Cb_2O_5.	SnO_2.	ThO_2.	UO_2	$(Y,Er)_2O_3$.	$(Ce,La,Di)_2O_3$.	CaO.	MgO.	FeO.	H_2O.	Total.
50·10	0·20	2·07	6·15	31·20	6·15	1·40	0·37	0·59	1·94	100·17

L. J. S.

Oncosine from Variney (Valle d'Aosta). Giuseppe Piolti (*Atti R. Accad. Sci. Torino*, 1909, 44, 743—746).—This sample of oncosine has the hardness 2·5 and D^{16} 2·819, and on analysis gives the following results :

SiO_2.	Al_2O_3.	FeO.	MgO.	K_2O.	Li_2O.	H_2O.	Total.
50·98	25·63	0·35	6·31	12·32	trace	4·14	99·73

Oncosine can be distinguished by its green colour and density, and by the fact that it swells when fused, from cossaite (a variety of paragonite), which is bluish-green, does not swell when melted, and has D 2·95. T. H. P.

Synthesis of Chlorite by the Action of Alkaline Solutions on Pyroxene. Georges Friedel and Grandjean (*Bull. Soc. franç. Min.*, 1909, 32, 139—150).—Augite, when heated with a solution of sodium aluminate in a platinum tube for thirty-six hours at 550—560°, gave rise to long needles of natrolite, octahedra of spinel (?), and scales of chlorite (?). Diopside heated with a solution of sodium hydroxide under the same conditions gave rise to reddish-brown scales, 1/10 mm.

across, of chlorite, which are optically biaxial and positive, and strongly pleochroic. Analysis of this product, which is near to penninite, gave:

SiO_2	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	H_2O.	Total.	Sp. gr.
28·4	15·2	4·4	2·3	36·2	11·5	98·0	2·67—2·70

L. J. S.

Druse Minerals in the Granite of Waldstein, Fichtelgebirge.

V. DÜRRFELD (*Zeitsch. Kryst. Min.*, 1909, 46, 563—598).—A detailed description is given of twenty-one mineral species found in the drusy cavities of the granite of Waldstein (at Epprechtstein and Grosse Waldstein); these include quartz, orthoclase, albite, zinnwaldite, topaz, tourmaline, cassiterite, etc., and the rarer species, herderite and euclase. Analyses are given of the following. Orthoclase: I, a white Baveno-twin from Epprechtstein; II, a pea-green Baveno-twin from Grosse Waldstein. Zinnwaldite, III. Muscovite, IV. Albite, V, from Epprechtstein, and VI from Grosse Waldstein. Gilbertite, as yellowish-green to white, granular-scaly aggregates, D 2·65—2·72, VII:

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	F.	Loss on ignition.	Total (less O for F).	Sp. gr.
I.	64·60	20·48	trace	—	0·36	0·48	10·98	3·95	—	0·33	101·18	2·493
II.	65·60	19·45	trace	—	2·16	trace	7·68	4·68	—	0·24	99·81	2·505
III.	46·90	24·68	—	2·92	1·25	0·97	9·87	1·51	6·60	2·98	99·13*	—
IV.	46·54	30·39	4·42	2·98	0·35	0·94	5·57	1·44	0·58	5·31	98·52	2·72
V.	66·26	20·74	trace	—	0·53	trace	0·58	11·22	—	0·41	99·76	—
VI.	67·11	21·41	trace	—	0·12	trace	trace	10·52	—	0·42	99·58	—
VII.	47·19	30·69	2·20	2·83	trace	0·80	6·74	3·73	0·53	5·11	99·82†	—

* Including Li_2O, 4·22; MnO, trace. † Also trace Li_2O.

L. J. S.

Cossyrite from Pantelleria.

J. SOELLNER (*Zeitsch. Kryst. Min.*, 1909, 46, 518—562).—A detailed description is given of the small, prismatic crystals of cossyrite which are found weathered out of the pantellerite of the island of Pantelleria. The crystallographic constants are: $a:b:c: = 0·66856:1:0·35173$; $\alpha = 90°4\frac{3}{4}'$; $\beta = 102°30'$; $\gamma = 90°18\frac{1}{2}'$. The angle between the good prismatic cleavages $m\{110\}$ and $\mu\{1\bar{1}0\}$ is 66°16′; D 3·802. The following analysis by M. Dittrich gives the formula:

$$(H_2)_2(Na_2)_3(Fe'',Mn,Mg,Ca)_{15}(Fe''',Al)_2(Si,Ti)_{22}O_{67}.$$

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_4.	FeO.	MnO.	MgO.
40·83	8·22	0·20	5·31	34·71	1·39	0·57

CaO.	Na_2O.	K_2O.	H_2O.	Total.
0·77	6·61	trace	1·29	99·90

Cossyrite, ænigmatite, and rhönite (Abstr., 1907, ii, 972) are considered to form a group of isomorphous minerals intermediate between the pyroxenes and amphiboles, the two former representing the alkali members of the series, and the last, a member rich in sesquioxides. L. J. S.

Analysis of Neptunite from San Benito Co., California. W. M. Bradley (*Amer. J. Sci.*, 1909, [iv], 28, 15—16; *Zeitsch. Kryst. Min.*, 1909, 46, 516—517).—The supposed new mineral, carlosite, found with benitoite in San Benito Co., California (Abstr., 1907, ii, 705), has already been proved to be identical with the neptunite from Greenland. The following results (mean of two analyses) lead to the same formula, $R'_2R''_2TiSi_4O_{12}$, and differ from the analyses of the Greenland mineral only in showing rather less manganese with correspondingly more calcium and magnesium.

SiO_2.	TiO_2.	MnO.	CaO.	MgO.	FeO.	K_2O.	Na_2O.	Total.
52·87	17·82	0·85	1·56	1·44	11·69	5·08	9·56	100·88

L. J. S.

Principal Uranium and Thorium Minerals. Béla Szilard (*Le Radium*, 1909, 6, 233—240).—The paper consists of a table of 111 minerals, setting forth their main constituents, crystalline character, percentage of uranium or thorium or both, and the localities where they occur. From the accompanying map of the world with these localities marked, no conclusion can be drawn, since the large tracts where no uranium or thorium is found have probably not been thoroughly searched. R. J. C.

Physiological Chemistry.

Dissociation Curve of Blood. Joseph Barcroft and Mario Camis. **Dissociation Curve of Hæmoglobin.** J. Barcroft and Fr. Roberts (*J. Physiol.*, 1909, 39, 118—142, 143—148).—Curves of the dissociation of hæmoglobin in water and in saline solutions are given, and confirmation obtained of Bohr's curves of hæmoglobin in water, and of the effect of carbon dioxide in dissociating oxygen from blood. The differences between the curves obtained from dog's and human blood are due to differences in the saline constituents of the red corpuscles. There is no reason for departing from the view that the oxygen is united chemically with hæmoglobin, and that this union is fundamentally a mass action of the type: $Hb + O_2 \rightleftharpoons HbO_2$. The hyperbolic form of Hüfner's curve is confirmed. W. D. H.

Bio-chemistry of Hæmolysis. Benjamin Moore, Frederick P. Wilson, and Lancelot Hutchinson (*Bio-Chem. J.*, 1909, 4, 346—368).—The hæmolytic agent and the substance attacked have a powerful mutual effect on one another's solubilities. As a result, phosphatides are dissolved out of the corpuscle, so setting free hæmoglobin. The class of unsaturated soaps of fatty acids, saponin, mowrin, digitalin, and bile salts possess common properties, and are all unsaturated substances capable of bromination. Their effect on tho heart also is probably due to combination with the cardiac lipoids. Although no line can be drawn between physical and chemical action, the first step appears to be "physical," namely, one of lowering of surface tension with an accompanying tendency to solution. The balancing action of hæmolysers is discussed, but in the case of closely similar hæmolysers, an additive action is obtained. In the case of balancing, the interaction of two hæmolysers leaves nothing free to touch the corpuscles. Thus a mere trace of oleate breaks down corpuscles in saline suspension, but in serum much more must be added, for complement or the serum proteins alone act as protectors. The oleates ought not, however, to be described as anti-complements, as probably there is no specific action between them and the complement. Sodium oleate can also be balanced by lecithin. In alkaline solution, oxidising agents favour, and reducing agents restrain, hæmolysis, but an oxidising agent alone cannot replace complement in an active hæmolytic serum, and it is not probable that complement has the nature of a peroxide. W. D. H.

Hæmolytic Action of Certain Bile Derivatives. HUGH MACLEAN and LANCELOT HUTCHINSON (*Bio-Chem. J.*, 1909, **4**, 369—384).—The sodium salts of cholic, choleic, and glycocholic acids are hæmolysers. The minimum dose giving the maximum effect in the shortest time is termed the "minimal-optimum hæmolytic dose." For instance, it was found that in the case of sodium cholate, 0·1 c.c. of 0·1*M*-solution is the minimal-optimum dose; mixed with 1 c.c. of 5% sheep's red corpuscles (the total volume being made up to 5 c.c.), hæmolysis was complete within five minutes. Stronger solutions gave a much less marked effect, a solution eight times as strong requiring 155 minutes, and a dose eighty times as large requiring thirteen minutes to produce the same effect. In all cases, cholesterol produced a marked anti-hæmolytic effect. The addition of fresh sheep's serum is also anti-hæmolytic, but in some cases an apparent augmentation is evident. This was due to the amount of serum used being unable to completely neutralise the laking action of the bile salts; hence a relative smaller amount of active hæmolyser being present, a more powerful effect is produced, as the amount of hæmolytic agent then approaches the minimal-optimum dose. The inhibitory action of serum does not depend on the presence of complement; an inactivated serum acts equally well. W. D. H.

Influence of Cholesterol on Hæmolysis by Soaps. HENRI ISCOVESCO (*Arch. exp. Path. Pharm.*, 1909, **61**, 94).—Note on a paper by Meyerstein (this vol., ii, 681); the author had already shown that if cholesterol is to inhibit the hæmolytic action of sera and of soaps, it must first be incubated with them. G. B.

The Amount of Peptolytic Ferments in Rabbits' and Dogs' Plasma, [and in the Red Blood Corpuscles of these Animals] under Various Conditions. EMIL ABDERHALDEN and LUDWIG PINCUSSOHN (*Zeitsch. physiol. Chem.*, 1909, **61**, 200—204).—Differences occur in different species of animals in the peptolytic properties of the blood plasma. Thus the plasma (or serum) of the rabbit rapidly decomposes glycyl-*l*-tyrosine into its components, whilst that of the dog has little or no action. If the animals are previously treated with injections of horse-serum or egg-white, the peptolytic power of the blood is increased. W. D. H.

Production of Immune Substances. The Differences in Agglutinin-content in Plasma and Serum. Georges Dreyer and E. W. Ainley Walker (*J. Path. Bact.*, 1909, 14, 28—38, 39—48).—Evidence is adduced that complement and specific immune substances are produced as secretions by the leucocytes. The plasma is richer in agglutinin than the serum; this is due to adsorption by the clot and corpuscles; a subsequent rise in agglutinin-content is due to secretion from the leucocytes. W. D. H.

An Anti-serum to Globin. Carl H. Browning and G. Haswell Wilson (*J. Path. Bact.*, 1909, 14, 137—138).—The injection of globin in animals produces an anti-globin. The action is specific; thus the protein constituents of the hæmoglobin of different species differ in their bio-chemical characters. W. D. H.

Digestion in the Animal Body. XXXIII. The Rôle of the Intestinal Epithelium in the Digestion and Absorption of Proteins. E. S. London (*Zeitsch. physiol. Chem.*, 1909, 61, 69—71. Compare this vol., ii, 593).—The intestinal epithelium of eight dogs in inanition was compared with that of the same number of animals two hours after an abundant meal of gliadin. The latter yielded on hydrolysis about twice as much glutamic acid as the former. The interpretation of this result is not attempted. W. D. H.

The Time Relations in the Course of Protein Decomposition with Different Diets. Th. Boettcher and Hans Vogt (*Arch. exp. Path. Pharm.*, 1909, 61, 7—17).—When dogs are fed on meat, the excretion of nitrogen in the urine is delayed, if after feeding, relatively small quantities of dextrose are administered intravenously or subcutaneously. G. B.

Origin of Uric Acid. R. H. Aders Plimmer (*J. Physiol.*, 1909, 39, 98—117).—Details of a metabolism experiment on a healthy man are given on a meat diet, a purine-free diet, and a purine-rich diet. Administration of guanine and xanthine did not increase the uric acid output; administration of large amounts of purines in herring-roe increased the output, but the excess of uric acid only corresponded with about a tenth of the total purines ingested. Liebig's extract caused a great increase, more than half the purines in it being converted into uric acid. In fact, scarcely any relation between purines and uric acid was found, and the prevalent opinion that the purines of the food and tissues are the sole source of uric acid needs revision, so also do prevailing views on uricolysis. W. D. H.

The Value of Protein Cleavage Products in Metabolism. X. Emil Abderhalden (*Zeitsch. physiol. Chem.*, 1909, 61, 194—199. Compare this vol., ii, 327).—Dogs were fed (*a*) on the cleavage products of casein; (*b*) on the same from which *l*-tryptophan had been removed, and (*c*) on the same to which *l*-tryptophan had been added. *a* and *c* maintained equilibrium, whilst *b* did not. Sickness and diarrhœa were observed, as in former experiments, but the cause of these symptoms is not clear. W. D. H.

Nuclein Metabolism in a Dog with an Eck's Fistula. EMIL ABDERHALDEN, E. S. LONDON, and ALFRED SCHITTENHELM (*Zeitsch. physiol. Chem.*, 1909, 61, 413—418).—When the liver is thrown out of gear by the performance of an Eck's fistula, the cleavage of nucleic acid and the deamidising and oxidation of purine bases are not affected, but the conversion of uric acid into allantoin is lessened; it therefore appears that other organs besides the liver are concerned in nuclein metabolism. W. D. H.

Action of Pancreatic Juice on Glycogen, Starch, and its Compounds. Mme. Z. GRUZEWSKA and BIERRY (*Compt. rend.*, 1909, 149 359—361).—Normal pancreatic juice acts less readily on glycogen and amylopectin than on starch. In each case the rapidity of the action is increased by neutralising the alkalinity of the pancreatic juice.
N. H. J. M.

Absorption of Protein. OTTO COHNHEIM and F. MAKITA (*Zeitsch. physiol. Chem.*, 1909, 61, 189—193. Compare this vol., ii, 414).—Surviving fish intestine was filled with peptone solution and suspended in Ringer's fluid. After some hours, nitrogen was found in the outer fluid, and a considerable quantity of it was in the form of ammonia. Ammonia was similarly detected during the absorption of aspartic acid and of lysine. If glycine or tyrosine was employed, no ammonia could be detected; in the case of glycine, a relatively small amount of a volatile base was found, but no glyoxylic acid. In the case of tyrosine, the outer fluid also contained a volatile base, and gave the diazo-reaction. If the intestine of a dog or cat filled with a solution of tyrosine or glycine was employed, the outer fluid contained ammonia. W. D. H.

Lecithin and other Components of Egg-yolks. E. TORNANI (*Boll. Chim. Farm.*, 1909, 48, 520—521).—The proportion of lecithin occurring in egg-yolk varies considerably. The yolks of eggs, which have apparently kept well, exhibit, after some time, substantial alterations in their composition, especially in respect to the quantities of lecithin and cholesterol they contain. In this regard, too, marked differences are found between fertilised and unfertilised eggs.
T. H. P.

Degradation of Glycogen and Formation of Sugar in the Liver of Normal Dogs, and of those Deprived of their Pancreas. HANS HINSELMANN (*Zeitsch. physiol. Chem.*, 1909, 61, 265—275).—The first rise in the sugar of the blood after extirpation of the pancreas is attributed to an increased formation of sugar in the liver, and an increased breakdown of glycogen in the liver. A number of experiments bearing this out are quoted, and a definite action of the pancreas is upheld, in spite of Pflüger's opinions.
W. D. H.

Effects of Temperature on the Osmotic Properties of Muscle. D. H. de Souza (*Quart. J. exp. Physiol.*, 1909, 2, 219—228). —A solution of sodium chloride isotonic for an injured muscle at one temperature is isotonic for muscle at other temperatures provided coagulation does not occur. Both the gain and loss of weight in a muscle in hypotonic or hypertonic solutions are increased in rapidity by rise in temperature. W. D. H.

Action of Guanidine on Muscles. Mario Camis (*J. Physiol.*, 1909, 39, 73—97).—Guanidine acts on frog's muscles by producing spontaneous twitching and by affecting their contractility; the former effect is inconstant, and can also be obtained on denervated muscles. The effect on contractility is the same on normal muscles, and in those in which the nerve-endings are degenerated. The hypothesis adopted is that guanidine acts by combining with two different substances in the muscle, one of which is responsible for the twitches and the other for changes in contractility. W. D. H.

Organ-extracts of Selachian Fishes. II. A. Suwa (*Pflüger's Archiv*, 1909, 129, 231—239. Compare this vol., ii, 685).—This paper gives further details of trimethylamine oxide found in extract of selachian muscle, and never before found either in the animal or vegetable organism. Its identity was further proved by the preparation of trimethylamine from it by distillation with concentrated potassium hydroxide and zinc, and by the analysis of certain of its salts (chloride, picrate, platinichloride). Trimethylamine is formed from it by putrefaction. Intravenous injection of the hydrochloride causes a slight and somewhat prolonged rise of arterial pressure. Feeding rabbits with the base, or injecting it subcutaneously, is followed by its partial destruction in the body, and an appearance of part in the urine as trimethylamine and dimethylamine. W. D. H.

Chemical Composition of Ox-bile. N. Alberto Barbieri (*Compt. rend.*, 1909, 149, 150—152).—A description of a method for separating the constituents of bile by means of selective solvents. Besides neurine, cholesterol, tristearin, biliverdin, proteins, and the usual biliary salts, the author has isolated from ox-bile a bitter *resin* containing C 61·67, H 9·36, N 2·1, S 1·35, P 0·35, ash 3%, and a yellow powder, soluble in water, for which the name "crude biline" is suggested. This substance is a mixture rich in mineral matter, but free from sulphates; it forms a copper derivative, from which a yellow, crystalline colouring matter has been obtained. W. O. W.

The Bile of Polar Animals. III. The Bile of the Walrus. Olof Hammarsten (*Zeitsch. physiol. Chem.*, 1909, 61, 454—494. Compare Abstr., 1901, ii, 520; 1903, ii, 86; 1904, ii, 831).—Walrus bile contains no glycocholic acid, but another acid of doubtful composition; it may be either choleic, deoxycholic, or β-phocæcocholic acid. Taurocholeic acid is found in addition to taurocholic acid, but the chief constituent is a new acid, sparingly soluble in water, and readily crystallisable therefrom, which is named *α-phocætaurocholic* *acid*, but is probably tauro-oxycholic acid. Its sodium salt has a_D + 41°; the cholic acid obtained from it appears to have the formula

$$C_{22}H_{36}O_5,$$

and its sodium salt has a_D + 35—36°, and m. p. 152—154°; it does not give a blue iodine compound. Another acid of the same group present is β-phocætaurocholic, which yields a cholic acid with formula $C_{24}H_{40}O_5$ (*iso*cholic acid); this crystallises from acetone, melts at 220—222°, and resembles a choleic acid in yielding a sparingly soluble barium salt, and showing no colour reaction with hydrochloric acid. It also does not give a blue iodine compound. W. D. H.

Existence of Carbophosphates in Milk. Their Precipitation by Pasteurisation. A. Barillé (*Compt. rend.*, 1909, 149, 356—358).—Pasteurised milk was found to contain more insoluble and soluble phosphoric acid than the original milk, whilst phosphoric acid in the form of calcium and magnesium carbophosphates was almost entirely precipitated. N. H. J. M.

Excretion of Iodine from the Dog's Organism, when given in the Form of 3 : 5-Di-iodo-*l*-tyrosine, 3 : 5-Di-iodoglycyl-*l*-tyrosine, 3 : 5 Di-iodo-*d*-iodopropionyl *l*-tyrosine, and 3 : 5-Di-iodopalmityl-*l*-tyrosine. Emil Abderhalden and Slavu (*Zeitsch. physiol. Chem.*, 1909, 61, 405—412).—If 3 : 5-di-iodo-*l*-tyrosine is given, it is easily decomposed in the dog's organism, and liberates iodine, whereas in the case of 3 : 5-di-iodoglycyl-*l*-tyrosine, the iodine largely appears in the urine in organic combination. 3 : 5-Di-iodo-*d*-iodopropionyl-*l*-tyrosine also readily gives up a part of its iodine. After the subcutaneous administration of these compounds of iodine, relatively large quantities are excreted into the intestine and are found in the fæces. W. D. H.

The Limits of Hippuric Acid Formation in Man and the Technique of Hippuric Acid Estimation. Joh. Lewinski (*Arch. exp. Path. Pharm.*, 1909, 61, 88—93).—Reply to Brugsch's criticism (*Zeitsch. exp. Path Ther.*, 5, pt. 3) of the author's method of hippuric acid estimation (Abstr., 1908, ii, 518). The author adheres to his statement that the amount of hippuric acid in the urine after the administration of benzoic acid is much greater than that found by other observers. G. B.

Protein Metabolism in Cystinuria. Horatio B. Williams and Charles G. L. Wolf (*J. Biol. Chem.*, 1909, 6, 337—348).—The following points were investigated in a case of cystinuria; increase of protein in the diet led to an increase in the output of "neutral sulphur," probably due to an increase in cystine excretion. If cystine was given by the mouth, the increase of neutral sulphur in the urine was small, the greater amount of the cystine given being oxidised and appearing as inorganic sulphates, as in health. If tyrosine was given, none appeared in the urine; if the tyrosine was absorbed, the patient was able to deamidate the 2 grams given. No diamines or amino-acids were found in the urine. W. D. H.

Unestimated Substances in Diabetic Urine. HENRI LABBÉ and G. VITRI (*Compt. rend.*, 1909, 149, 415—418).—In addition to the normal organic substances, indeterminable by direct analysis, the urine of diabetic patients contains considerable quantities of unexplored materials quite distinct from the ordinary pathological carbohydrates. The amount of these unknown products has been determined in a number of cases by subtracting from the total organic extract the number obtained by multiplying the total nitrogen by 1·21, this being the factor for indeterminable material in normal urine. The results, which are given in tabular form, show that the amount of abnormal diabetic material may exceed the weight of sugar present. The extreme values encountered were 2·8 grams and 146·9 grams for the urine of twenty-four hours. W. O. W.

Diabetic Lævulosuria and the Detection of Lævulose in Urine. WILHELM VOIT (*Zeitsch. physiol. Chem.*, 1909, 61, 92—94. Compare this vol., ii, 688).—Polemical. Borchardt's test for lævulose is regarded as untrustworthy. W. D. H.

The Ferments of Nuclein Metabolism in Gout. J. R. MILLER and WALTER JONES (*Zeitsch. physiol. Chem.*, 1909, 61, 395—404).—The uricolytic enzyme is absent from the human liver in gout, but this cannot be the cause of that disease, for Wiechowski's statement that the same is true for normal human organs is confirmed.

Just as guanase is absent from the organs of the pig, so is adenase absent from those of man. The principal seat of uric acid formation (from guanine) is the liver, and that organ in man is rich in guanase and xantho-oxydase. Guanase is also present to some extent in the lung and kidney, but it is absent from the spleen. W. D. H.

Cholesterol in Cerebro-spinal Fluid. GIACOMO PIGHINI (*Zeitsch. physiol. Chem.*, 1909, 61, 508—516).—In a number of organic nervous diseases (progressive paralysis, dementia præcox, etc.), cholesterol is often found in the cerebro-spinal fluid. The fluid from normal cases, or cases of functional disease, is free from cholesterol. In the majority of cases of epilepsy it is also absent. It is believed that, like choline, it originates from the breakdown of nervous tissues, and it probably plays a part in the Wassermann reaction. W. D. H.

Contents of a Pancreatic Cyst. G. DORNER (*Zeitsch. physiol. Chem.*, 1909, 61, 244—255).—The contents of the cyst differed considerably from pancreatic juice obtained in cases of fistula. The amount of protein was increased, but no trypsin or protrypsin was present. The diastatic and lipolytic enzymes were present.

W. D. H.

The Presence of a Dye Resembling Urorosein in Certain Pathological Urines. VINCENZ ARNOLD (*Zeitsch. physiol. Chem.*, 1909, 61, 240—243).—In convalescents from scarlet-fever, urorosein often occurs in their urine. Simultaneously another pigment also occurs which differs from urorosein in some of its properties, includin the absorption-spectrum. The name *nephrorosein* is suggested.

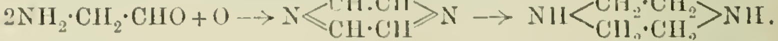
W. O. W.

Action of Ultraviolet Rays on the Tetanus Toxine. P. Cernovodeanu and Victor Henri (*Compt. rend.*, 1909, 149, 365—368).—The action of ultra-violet rays on the tetanus toxine was found to increase when the solution is diluted. This increased action is due to the dilution of the broth which absorbs the active rays. The action of the rays is the same in absence of air as when air is present.

Small amounts of iodine and of hydrogen peroxide increase the activity of the tetanus toxine; larger amounts destroy it.

N. H. J. M.

Behaviour of Aminoacetaldehyde in the Animal Organism. T. Kikkoji and Carl Neuberg (*Biochem. Zeitsch.*, 1909, 20, 463—467. Compare this vol., i, 702).—Aminoacetaldehyde, given to rabbits by the mouth, is excreted in the urine as pyrazine; the same oxidation can readily be brought about *in vitro*. Spermine (=piperazine?) is probably derived from pyrazine by reduction:



$$2NH_2\cdot CH_2\cdot CHO + O \longrightarrow N{\lessgtr}\begin{matrix}CH{:}CH\\CH\cdot CH\end{matrix}{\gtrless}N \longrightarrow NH{<}\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}{>}NH.$$

G. B.

Tetraethylarsonium Iodide and its Pharmacological Action. Sossja Gornaja (*Arch. exp. Path. Pharm.*, 1909, 61, 76—87).—An improved method of preparation of the substance (from arsenic and ethyl iodide) is described. Its central paralytic action is four times as great as that of the tetramethyl derivative; it possesses neither a curare nor a specific arsenic action. G. B.

Chemistry of Vegetable Physiology and Agriculture.

Bacteria which Decompose Cyanamide. Hubert Kappen (*Centr. Bakt. Par.*, 1909, ii, 24, 382—404).—Successive cultivations in solutions of calcium cyanamide and cyanamide yielded bacteria which decompose cyanamide under certain conditions. No decomposing action due to carbon dioxide was observed, and organic acids, such as acetic, butyric, or lactic acids, are also without action on cyanamide when employed in amounts such as might be produced from the dextrose. The favourable action of dextrose in promoting the decomposition of cyanamide cannot, therefore, be due to fermentation products; it is probably due to a physiological action on the bacteria.

Certain fungi, having strong reducing power, seem to play an important part in the decomposition of cyanamide. N. H. J. M.

Alcoholic Fermentation in Presence of Sulphurous Acid. af Martinand (*Compt. rend.*, 1909, 149, 465—467).—The feeble able entation which occurs when brewer's yeast is introduced into were fo uice containing free sulphurous acid is caused, not by the yeast cells, but by micro-organisms resembling *Torula.* These bring about the formation of aldehydes, with which the sulphurous acid enters into combination; a part of the acid also undergoes oxidation to sulphuric acid. Normal yeast fermentation does not occur until the sulphurous acid has disappeared. W. O. W.

Life of Yeast after Fermentation. E. KAYSER and A. DEMOLON (*Compt. rend.*, 1909, **149**, 152—155. Compare Abstr., 1907, ii, 714; 1908, i, 317; this vol., ii, 170; Trillat, Abstr., 1908, ii, 615).—White wine was exposed in shallow vessels, at different temperatures, to the action of yeast for six months, and the amount of alcohol and volatile acids and the total acidity determined at the commencement and at the end of this period. Similar experiments were carried out on red wine kept in long-necked flasks, completely filled to prevent access of air. In each case the aldehydes, esters, and higher alcohols were determined in the corresponding "eau de vie."

The results are given in tabular form. A disappearance of alcohol was observed in each case; the extent to which this occurred was dependent on the history of the yeast and on the nutriment provided (ammonium sulphate or leucine). The disappearance was most marked in the shallow vessels exposed to air, due allowance having been made for loss by evaporation.

The amount of aldehydes was considerably increased, whilst the total acidity was diminished. The proportion of furfurol was increased in presence of leucine, whilst the amount of esters and of higher alcohols remained fairly constant. As in the cases studied previously, the addition of mercuric chloride has a protecting influence on the alcohol. It would appear, therefore, that, after fermentation is complete, the yeast cells behave as physiologically normal cells, the intramolecular respiration being succeeded by normal respiration, during which the yeast, even at low temperatures, utilises the organic acids as nutritive material. W. O. W.

Addition of Ammonium Salts in the Fermentation of Fruit and Grape Wines. A Correction. BIERBERG (*Centr. Bakt. Par.*, 1909, ii, **24**, 404—405. Compare this vol., ii, 423).—Addition of ammonium salts in the fermentation of wines is unnecessary when there is no excess of sugar present, and may even retard fermentation. N. H. J. M.

Influence of Anæsthesia and of Cold on the Fission of Certain Glucosides in Plants. LÉON GUIGNARD (*Compt. rend.*, 1909, **149**, 91—93. Compare Mirande, following abstract).—Exposure of living plants to the action of anæsthetics brings about interaction between the glucoside and the corresponding ferment. Thus mustard oil is formed in abundance when the leaves of certain *Cruciferae* are submitted to the action of chloroform.

The same phenomenon is brought about by exposure to cold, produced by the evaporation of methyl chloride. Under the same conditions, *Gaultheria procumbens* liberates methyl salicylate, whilst cyanogenetic plants evolve hydrogen cyanide. W. O. W.

Influence of Certain Vapours on Vegetal Cyanogenesis. Rapid Method for Detecting Plants containing Hydrogen Cyanide. Marcel Mirande (*Compt. rend.*, 1909, **149**, 140—142. Compare Guignard, preceding abstract).—Cyanogenetic plants liberate hydrogen cyanide when exposed to the action of substances which inhibit their chlorophyllic functions, such as mercury vapour, carbon disulphide, or anæsthetics, such as chloroform. The phenomenon is readily observed by placing under a clock glass a laurel leaf, together with some chloroform and a piece of Guignard's sodium picrate paper (*Bull. Sci. Pharm.*, 1906, 13). In a few minutes the latter turns from yellow to red under the action of the hydrogen cyanide. The phenomenon is independent of the action of light.

This reaction is recommended as affording a convenient method for recognising cyanogenetic plants. W. O. W.

Rennet of Belladonna. C. Gerber (*Compt. rend.*, 1909, **149**, 137—139. Compare Abstr., 1907, i, 1100; this vol., ii, 512).—A description of the properties of the rennet of *Belladonna* and of its distribution in the plant. The distribution of the diastase corresponds approximately with that of the alkaloids, the leaves containing more than the root and the root more than the stem. Rennet is found in all the components of the stalk and root, even in the wood fibre. The rennet is extremely resistant to the action of heat; it has an optimum temperature of 90°, and readily brings about coagulation of boiling milk. It is only feebly activated by calcium salts, whilst salts of the alkali metals have a retarding influence. The behaviour of the diastase in presence of alkalis resembles that of the vegetable rennets previously studied, in presence of sodium fluoride (*Compt. rend. Soc. Biol.*, 62, 1223). The latter substance exerts an accelerating influence only in the presence of sodium chloride. W. O. W.

Phosphoric Acid in Plant Leaves. Josef Seissl (*Zeitsch. landw. Vers-Wesen Osterr.*, 1909, **12**, 157—167).—An investigation on the occurrence of phosphorus in the leaves of plants during different seasons of the year. The total phosphorus was estimated, also the proportions of this element organically combined and soluble in organic solvents. The analytical results obtained from different plants are tabulated, and indicate that, as a rule, the phosphorus content of the leaves reaches its maximum in June or July (the period of greatest growth), a steady decrease being noted from that time until October. In the case of a maple (*Acer pseudoplatanus*), however, the total phosphorus reached its maximum in August. It was also found that red leaves contained less phosphorus than the green ones obtained from the same plant. F. M. G. M.

Carbohydrates contained in Plant Seeds. Ernst Schulze and Ch. Godet (*Zeitsch. physiol. Chem.*, 1909, **61**, 279—351).—The object of this investigation was to determine the nature of the carbohydrates present in the seeds of plants.

None of the kernels of the seeds investigated was found to contain either pentoses or hexoses.

Twenty-seven varieties were examined for sucrose, and in only two cases with a negative result, possibly because the quantities present were so small as to render its isolation impossible. Other soluble carbohydrates are always present; these, as a rule, yield mucic acid when oxidised, from which fact the conclusion may be drawn that they would yield galactose on hydrolysis. Only in three cases has this carbohydrate been isolated; raffinose is found in wheat, whilst lupeose has been isolated from the yellow lupine (*Lupinus luteus*) and the blue lupine (*Lupinus angustifolius*).

Pentosans are present in very small quantities (less than 1%) in some seeds, whilst they are totally absent in others.

The fact that the soluble carbohydrates present in seeds are derived from dextrose, lævulose, and galactose, shows that these sugars are particularly suitable for the nutrition of the young plant, since there can be little doubt that these carbohydrates serve as reserve materials and are broken down into the simpler sugars during germination.

Insoluble carbohydrates, namely, starches, celluloses, and hemicelluloses, are also present in the seed-kernels. The hemicelluloses on hydrolysis yield a mixture of hexoses; many yield galactose, ohters mannose; several also yield a pentose, probably arabinose.

The seed husks and shells contain only very small quantities of soluble carbohydrates. They are composed mainly of nitrogen-free substances insoluble in ether, water, and malt extract, of which the hemicelluloses are present in considerable quantities. The latter on hydrolysis yield arabinose, xylose, and galactose in varying quantities. The rest of the husk is composed of cellulose, wood-gum, lignin, and various indefinite, brown substances.

The portion of the cell-walls insoluble in hot dilute mineral acid contains cellulose, which, on hydrolysis, yields dextrose and sometimes mannose.
W. H. G.

Chemistry and Pharmacology of Insect Powder. J. Fujitani (*Arch. exp. Path. Pharm.*, 1909, 61, 47—75).—The powder (from flowers of *Chrysanthemum cinerariaefolium*) owes its activity to a neutral non-nitrogenous syrup, for which the name *pyrethrone* is suggested; it is an ester, and readily yields on hydrolysis the alcohol, *pyrethrol*, and various ill-defined acids. Pyrethrol, $C_{21}H_{34}O$, is physiologically inert; it has m. p. 199°, b. p. 290°; $[\alpha]_D^{20}$ in chloroform solution +72·75—73·75°; it yields a crystalline *acetyl* derivative, m. p. 222°.

Pyrethrone is a nerve poison, but not a protoplasmic poison. Fishes and insects are very susceptible to it, but protozoa are not affected. In warm-blooded animals the poison stimulates the various centres of the medulla, giving rise to epileptiform convulsions, etc.
G. B.

Analytical Chemistry.

A New Filtering Crucible. O. Brunck (*Chem. Zeit.*, 1909, 33, 649—650).—An ordinary Gooch crucible made of porcelain. The asbestos filter has, however, been replaced by a layer of spongy platinum firmly adhering to the porcelain. After weighing, the bulk of the precipitate is removed by gently tapping the crucible, and the last traces are removed with a suitable solvent. L. de K.

A New Apparatus for Fractional Distillation. Philippe Malvezin (*Bull. Soc. chim.*, 1909, [iv], 5, 835—838).—The author modifies the Lebel-Henninger column by removing the side-tubes and separating the bulbs by flat glass plates, pierced by thin, bent glass tubes which compel the ascending vapour to bubble through the condensed liquid after the manner of the Coffey still. Experiments described show an appreciable increase in efficiency. E. H.

Modification of Scheibler's Extractor for Use with Large Quantities of a Solid. C. Loring Jackson and Latham Clarke (*Amer. Chem. J.*, 1909, 42, 287—291).—An account is given of a form of Scheibler's apparatus (*Ber.*, 1880, 13, 338) for the extraction of solids on the continuous infusion principle. It is constructed of metal instead of glass, and is suitable for use when large quantities of material are to be extracted. For particulars of the various parts and their dimensions, the description and diagram in the original must be consulted. E. G.

Simplified Form of Constant Volume Ureometer. André Job and Clarens (*J. Pharm. Chim.*, 1909, [vi], 30, 97—100).—A description and sketch of a simple form of ureometer specially suitable for students' use, which is stated to give accurate results. The apparatus consists of a flask closed by a three-hole rubber stopper, and connected with a simple U-shaped manometer fitted with a sliding scale. The stopper is fitted with a 2 c.c. pipette, the upper end of which may be connected by rubber tubing to a piece of quill tubing inserted in the remaining hole. Twenty c.c. of hypobromite solution are placed in the flask, and 2 c.c. of urine drawn into the pipette and retained by a clip. The stopper is inserted, and the flask placed in a water-bath at the laboratory temperature. The tubing from the pipette is then connected with the quill tube, and when the manometer has become steady, the clip is removed, allowing the urine to fall into the flask. The pressure is then read on the manometer. It is necessary to calibrate the apparatus by determining the increase of pressure produced by a known weight of pure carbamide. W. O. W.

Estimation of Acids in Hydrogen Peroxide by Titration. Otto Lüning (*Zeitsch. angew. Chem.*, 1909, 22, 1549—1550).—If a definite quantity of hydrochloric or sulphuric acid is added to a pure 3%

solution of hydrogen peroxide, either direct or indirect titration in the cold with $N/10$-sodium hydroxide and phenolphthalein as indicator gives the exact amount of acid added. If, however, a definite quantity of sodium hydroxide is added to a solution of hydrogen peroxide and the latter heated until oxygen ceases to be evolved, titration with acid only gives half the amount of sodium hydroxide added (compare Endemann, this vol., ii, 432). On the other hand, if a known excess of acid is added to the alkaline solution after the evolution of oxygen has ceased, and the liquid again heated for a short time, titration with alkali gives the correct amount of sodium hydroxide previously added.

These results are explained by assuming that a sodium peroxide hydrate is formed which is relatively stable towards acids in the cold, but which is destroyed by warming with acids. They furthermore show that Endemann's method (*loc. cit.*) for determining the acidity of hydrogen peroxide solutions is incorrect; excess of sodium hydroxide should be added to the cold solution and titrated back with acid without previous heating.

Hydrogen peroxide and dilute sulphuric acid do not form persulphuric acid. T. S. P.

A Proposed Test for Halogens. G. B. NEAVE (*Analyst*, 1909, 34, 345—346).—Richmond (Abstr., 1908, ii, 530) noticed that when a substance containing a halogen is dissolved in alcohol and then shaken with mercury and sulphuric acid, a mercurous halide is formed. The author having made a number of experiments, arrives at the conclusion that the test answers fairly well qualitatively, but is unsuitable for quantitative purposes. L. DE K.

Estimation of Total Sulphur in Urine. STANLEY R. BENEDICT (*J. Biol. Chem.*, 1909, 6, 363—371).—The method proposed consists in carrying out the oxidation with a mixture of copper nitrate and sodium or potassium chlorate. It is claimed that the method is rapid, and gives practically the same results as Folin's sodium peroxide method.

W. D. H.

Estimation of Total Sulphur in Urine. STANLEY RITSON (*Bio-Chem. J.*, 1909, 4, 337—342, 343—345).—From the comparison of a number of urines, it is found that Schulz's method (oxidation with fuming nitric acid) gives the lowest results, whilst the Asbóth-Modrakowski method (oxidation with sodium peroxide) gives the highest figures, and must therefore be considered the most trustworthy of the methods at present in use. The Pringsheim (oxidation with sodium peroxide brought about by the introduction of a red-hot iron nail into the mixture), Konschegg (oxidation by fuming nitric acid and potassium nitrate), and Folin's modification of the Asbóth-Modrakowski method all give immediate figures.

The Asbóth-Modrakowski method possesses the disadvantage of being too lengthy for experiments, such as those on metabolism, where a large number of analyses have to be made, and a new method is recommended which gives still higher figures, and can be rapidly performed. The new method is a modification of the Pringsheim method, and consists in carrying out the oxidation with a mixture of barium peroxide and sodium peroxide in the proportion 1 : 7. A higher temperature is reached by fusion with this mixture; a red-hot iron nail is introduced, the reaction is over in a few seconds, and the barium sulphate formed in the reaction is collected and weighed.

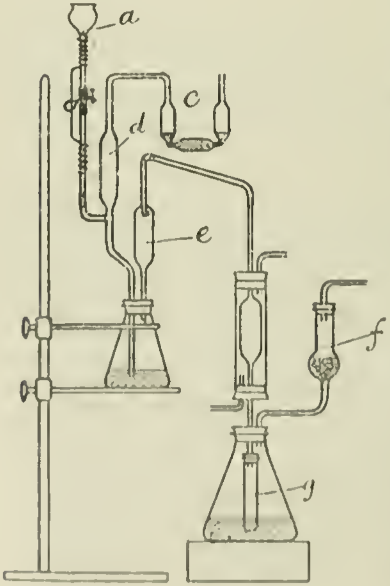
W. D. H.

Estimation of Combined Sulphur in Caoutchouc. TH. BUDDE (*Gummi Zeit.*, 1909, 23, 1143—1144).—About one gram of the caoutchouc is soaked during twenty-four hours in carbon tetrachloride (30—40 c.c.), and then treated with 250 c.c. of a brominating mixture (1000 c.c. of carbon tetrachloride, 6 c.c. of bromine, 1 gram of iodine). After a further six hours, 125 c.c. of alcohol are added, and the mixture filtered after twelve hours. The residue is treated with 10—15 c.c. of bromine, and, after twenty-four hours, diluted with water and heated on a sand-bath; the insoluble residue is boiled twice with water and washed successively with alcohol and ether. The sulphur is estimated in the filtrates by the known methods of Henrique, or Frank and Marckwald.

F. M. G. M.

Estimation of Sulphuric Acid as Barium Sulphate in Solutions containing Chlorides. JULIUS F. SACHER (*Chem. Zeit.*, 1909, 33, 941—942. Compare Ruppin, this vol., ii, 343).—In order to obtain accurate results, the solution should contain about 0·1 gram of the sulphate (reckoned as potassium sulphate) per 100 c.c. After heating to boiling and adding 1 c.c. of $N/5$-hydrochloric acid, a boiling 3% solution of barium chloride is added in about three times the theoretical quantity required. After fourteen hours, the precipitate is collected and washed with cold water until free from chlorides; hot water should not be used, as this dissolves barium sulphate to a slight extent.

L. DE K.



Modified Apparatus for Estimation of Nitrogen by the Kjeldahl Process. FRANK E. WESTON and HENRY R. ELLIS (*Chem. News*, 1909, 100, 50).—The accompanying diagram represents the apparatus for distilling off the ammonia in a Kjeldahl estimation. After diluting the sulphuric acid with water and cooling, sodium hydroxide solution is introduced

through the funnel *a*. Bulbs *c*, which are altogether of about 15 c.c. capacity, contain concentrated sulphuric acid, and are to prevent any ammonia entering the apparatus when air is drawn through. The bulb *d* is to prevent any sodium hydroxide solution from coming in contact with the acid in bulbs *c*. The trap *e* is to prevent any solid matter being carried over during distillation. Tube *f* contains broken glass, and is connected to the pump, and *g* is a small test-tube having a small hole at the bottom. During the distillation a steady current of air is drawn through the apparatus, enabling the operation to proceed with absolutely no bumping, and requiring very little attention.
J. V. E.

Estimation of Nitrates in Waters containing Chlorine. RENÉ MARCILLE (*Ann. Chim. anal.*, 1909, 14, 303—304).—Perrier and Farcy (this vol., ii, 344) having stated that nitrates cannot be determined directly by Grandval and Lajoux's process in the case of waters containing chlorine, the author recalls the fact that he has recommended the use of ammoniacal silver sulphate for removal of the chlorine (Abstr., 1902, ii, 173).
L. DE K.

Colorimetric Estimation of Phosphorus with Uranium Acetate and Potassium Ferrocyanide. ROBERT B. GIBSON and CLARENCE ESTES (*J. Biol. Chem.*, 1909, 6, 349—358).—The principle of the method is to add excess of uranium acetate solution to an aliquot part of the diluted fusion or digestion, and then, after filtering off the precipitated uranium phosphate, to determine colorimetrically the uncombined uranium with potassium ferrocyanide. The results are stated to be trustworthy.
W. D. H.

Estimation of Phosphoric Acid in Mineral Phosphates. GUNNER JÖRGENSEN (*Analyst*, 1909, 34, 392—393).—Minute details of the author's process—now the official one in Denmark. The essential points are that the phosphate is dissolved in boiling nitric acid, and the solution made up with water to a definite volume. In an aliquot part, the phosphoric acid is precipitated at 50° with an excess of molybdate solution, and the yellow precipitate is washed repeatedly with acid solution of ammonium nitrate. After dissolving the same in $2\frac{1}{2}\%$ ammonia, the liquid is heated to boiling and then precipitated with magnesia mixture. After four hours, the precipitate is collected in a platinum crucible filter, packed with spongy platinum, washed with $2\frac{1}{2}\%$ ammonia solution, then once with alcohol, dried, ignited, and weighed.
L. DE K.

Estimation of Phosphoric Acid in Metabolism Experiments. H. SCHAUMANN (*Zeitsch. anal. Chem.*, 1909, 48, 612—617).—The author prefers the process recommended by Neumann (Abstr., 1899, ii, 54). This consists essentially in destroying the organic matters by heating with concentrated sulphuric and nitric acids. When destruction is complete, the residue is heated further to expel the excess of nitric acid, and, after diluting with water and filtering, the phosphoric acid is estimated by the molybdate process; the resulting yellow precipitate is dissolved in $N/2$-sodium hydroxide, boiled to expel the ammonia, and the solution is titrated with $N/2$-hydrochloric acid, using phenolphthalein as indicator.

Convenient quantities to work on are 0·5—1 gram of seeds, flesh, animal or human organs. Of blood, 5 c.c. should be taken, and other liquids should be concentrated to about 5 c.c. A rather complicated but convenient suction apparatus is described for collecting and washing the yellow precipitate. L. de K.

Detection and Approximate Estimation of Small Quantities of Arsenic. R. Bensemann (*Zeitsch. angew. Chem.*, 1909, 22, 1804—1806).—A slight modification of the well known Otto apparatus. The reduction tube is heated in three places, thus ensuring at least two mirrors.

The author passes the gases over dry cotton wool and then through a U-tube containing a few sticks of sodium hydroxide before entering the reduction tube. The objections to the apparatus on account of danger of explosion, and to the use of sodium hydroxide as a drying agent, appear unfounded.

The mirrors obtained are compared with standard mirrors. The amount of arsenic present should, however, not exceed 0·2 mg., otherwise the mirrors become difficult of comparison. The method is specially recommended for ascertaining the purity of dyes. One gram of the sample is mixed with 5 grams of a mixture of nitre and sodium carbonate (1—2), and gradually transferred into a red-hot platinum crucible. The mass is then dissolved in water and mixed with 50 c.c. of 25% sulphuric acid. The whole is evaporated until sulphuric fumes cease, and then dissolved in water and diluted to 100 c.c. A suitable portion is then used for the test. L. de K.

Non-reducibility of Arsenic Acid in Alkaline Solution. Method of Detecting Arsenites in Arsenates. Ercole Covelli (*Boll. Chim. Farm.*, 1909, 48, 623—625).—Arsenic acid in alkaline solution resists all reducing agents, including nascent hydrogen, by which, however, arsenious acid is reduced to hydrogen arsenide. The following method admits of the detection of an arsenite in presence of an arsenate. To 5 c.c. of the liquid to be examined are added two potassium hydroxide pastilles, a piece of granulated zinc, and a piece of iron wire, the two metals being in contact in the liquid. In presence of arsenates alone, evolution of gas is slow, the surfaces of the metals remain bright, and a paper, moistened with ammoniacal silver nitrate solution and placed in the mouth of the test-tube, remains white. If, however, even a very small amount of arsenious acid is present, the development of hydrogen is more rapid, the zinc and iron blacken, and hydrogen arsenide is evolved. T. H. P.

Estimation of Small Quantities of Carbon Dioxide. Otto Warburg (*Zeitsch. physiol. Chem.*, 1909, 61, 261—264).—The method described is a modification of that of Pettenkofer, based on the observation that a hot solution of barium hydroxide absorbs carbon dioxide far more rapidly than a cold solution. By this method, small quantities of carbon dioxide (0·001 gram) may be estimated with an accuracy of 4—5%. A figure of the apparatus is given in the original. W. H. G.

Detection of Free Carbonic Acid in Water. Ludwig Bitter (*Hyg. Rundsch.*, 1909, **19**, 633).—The method consists in titrating the water with a solution containing 0·9091 gram of pure sodium hydroxide per litre, using phenolphthalein as indicator. F. M. G. M.

Micro-chemical Analysis. VII. The Last Group [Magnesium, Lithium, Potassium, and Sodium]. Nicolaas Schoorl (*Zeitsch. anal. Chem.*, 1909, **48**, 593—611. Compare this vol., ii, 762).—The residue freed from ammonium salts is dissolved in water and a little hydrochloric acid and the magnesium is precipitated with barium hydroxide, and, after being converted into magnesium ammonium phosphate, it is examined under the microscope. The filtrate is freed from barium hydroxide by means of carbon dioxide, and the solution is evaporated to dryness. Lithium chloride is then extracted with absolute alcohol, and, after expelling the alcohol, the residue is treated with a solution of sodium hydrogen carbonate; the lithum carbonate formed is then recognised under the microscope.

The residue insoluble in alcohol may contain potassium and sodium. Traces of potassium are best precipitated with cobaltic sodium nitrite, and then finally converted into the platinum double compound after igniting the cobalt compound. Either of the precipitates may be recognised microscopically. When much potassium is present, it is best removed by evaporation with ammonium perchlorate. The residue is then extracted with alcohol, and, after evaporating and igniting the residue, the sodium is converted into the double uranyl acetate compound and examined microscopically.

Advantage may be taken also of the insolubility of potassium hydrogen tartrate in alcohol. Ammonium may be set free with calcium oxide and then converted into the chloride. L. de K.

Volumetric Estimation of Calcium Oxide in Presence of Dissolved Silica. Karl Balthasar (*Chem. Zeit.*, 1909, **33**, 646—647).—0·7 Gram of the cement is treated in a porcelain dish with concentrated hydrochloric acid until decomposed, warming if necessary. The liquid is then transferred to a 350 c.c. flask, and the basin is rinsed with water, using altogether about 100 c.c. After boiling for a few minutes to expel any carbon dioxide, 50 c.c. of an ammoniacal mixture are added, the boiling being continued. This ammonia solution is prepared by placing in a litre flask 25 grams of ammonium chloride and 100 c.c. of concentrated acetic acid, and diluting with ammonia to the mark. While the liquid is still boiling, 50 c.c. of $N/2$-oxalic acid are added, the mixture is cooled, and diluted with water to the mark. The liquid is filtered, and in 50 c.c. of the clear filtrate the excess of oxalic acid is estimated by means of $N/10$-permanganate, after addition of 5 c.c. of sulphuric acid and a few c.c. of manganous sulphate solution. The amount of calcium oxide is then easily calculated. L de K

Estimation of Free Calcium Oxide in Cements. Robert Brandenburg (*Chem. Zeit.*, 1909, 33, 880).—It is proposed to estimate the amount of free calcium oxide by distillation with ammonium bromide dissolved in absolute alcohol. The ammonia liberated corresponds with the calcium oxide present. L. de K.

Estimation of the Hardness of Water by Clark's Method. Galeazzo Piccinini (*Atti. R. Accad. Sci. Torino*, 1909, 44, 842—857).—The author's experiments deal with the estimation of the hardness of waters containing known amounts of calcium, barium, and magnesium salts by means of Clark's method, various soaps being employed. The results obtained lead to the following conclusions.

With waters containing calcium and magnesium salts, the rapidity with which the estimation is effected has a considerable influence on the results when the soap used contains a preponderating proportion of alkali oleates. When calcium salts predominate over those of magnesium, results not greatly inferior to the true ones are obtained, even when working rapidly, provided that potash soap, prepared in the ordinary way from lead soap and potassium carbonate, is employed. Pure sodium or potassium oleate should not be used, since it yields erroneous values, which are low or high according as the calcium or magnesium salts predominate. The disturbing influence of marked quantities of magnesium salts is exorcised in the direction of giving high rather than low values for the hardness of a water. Alcoholic solutions of sodium stearate, prepared so that they correspond with Faist and Knauss's tables, contain a definite, stable salt, and give exact results quite independently of the rapidity with which the estimation is executed. T. H. P.

Estimation of Zinc, Copper, and Cobalt by means of Ammonium Hydroxide. Wilhelm Vaubel (*Zeitsch. angew. Chem.*, 1909, 22, 1716—1717).—The hydroxides of zinc, copper, and cobalt, which are obtained by precipitation with sodium hydroxide, do not filter readily and are difficult to wash. The author proposes the use of ammonium hydroxide in place of sodium hydroxide, the method of procedure being as follows: The solution of the salt is first made neutral to litmus by means of alkali hydroxide or sodium carbonate. Phenolphthalein is then added, and ammonium hydroxide until a red colour is obtained. In the case of copper, the ammonium hydroxide is added until the deep blue colour of an ammoniacal copper solution is formed; in the case of zinc, the solution is then heated to boiling until the red colour disappears, or until all the metal has been precipitated in the case of copper and cobalt. A slight excess of ammonium hydroxide is of no consequence, but a large excess should not be used, owing to the solvent action of ammonium salts on the precipitates in question. The preliminary neutralisation of the acid with sodium hydroxide is to prevent the accumulation of ammonium salts in solution. The results are quantitative.

T. S. P.

Quantitative Separation of Lead and Bismuth. J. C. GALLETLY and GEORGE G. HENDERSON (*Analyst*, 1909, 34, 389—391).—The authors recommend Clark's process (separation of the bismuth by means of steel wire, Abstr., 1900, ii, 371), but think the method may be improved by finally precipitating the bismuth from its hot solution, containing 2½% of free nitric acid, with sodium hydrogen phosphate, instead of ammonium carbonate. The precipitate, after being washed with acid water containing a trace of ammonium nitrate, is ignited and weighed as bismuth phosphate.

Attempts to separate lead from bismuth by taking advantage of the solubility of lead phosphate in nitric acid of 1—2·5% strength were unsuccessful. L. DE K.

Gravimetric Estimation of Copper Sulphate. P. B. DALLIMORE (*Pharm. J.*, 1909, [iv], 29, 271).—Three grams of the coarsely-powdered sample are heated in a porcelain dish on a water-bath with an excess of hypophosphorous acid, diluted with an equal volume of water, until the copper has completely precipitated as metal. This is washed with water until free from acidity, and then with alcohol and ether. Finally, it is burnt to oxide in a porcelain crucible and weighed as such. L. DE K.

Estimation of Mercury and Antimony Sulphides in Vulcanised Caoutchouc. FRANK and FELIX JACOBSOHN (*Gummi Zeit.*, 1909, 23, 1046).—The caoutchouc is cut into small fragments, evaporated down twice with nitric acid, and the operation repeated several times with the addition of potassium chlorate, and finally with hydrochloric acid. The residue is treated with the latter acid, the solution filtered hot, and diluted with water. As the viscous mass produced at this stage frequently hinders filtration, a more prolonged boiling with concentrated nitric acid may be necessary. The mercury and antimony are precipitated from the hot filtrate with hydrogen sulphide, the mixed sulphides collected, and weighed in a tared Gooch crucible after washing successively with alcohol, ether, carbon disulphide, and ether. The antimony sulphide is dissolved with yellow ammonium polysulphide, and the residual mercuric sulphide weighed. As a further control, the antimony is converted into tetroxide by treatment with nitric acid in a tared basin. Any other metals present are estimated in the filtrate from the mixed sulphides.

F. M. G. M.

Rapid Estimation of Iron in Iron Ores. JAMES S. MACLAURIN and WILLIE DONOVAN (*J. Soc. Chem. Ind.*, 1909, 28, 827—828).—The finely-powdered ore is introduced into a hard glass bulb-tube and, if necessary, ignited in a current of air to expel volatile matters. It is then heated in a current of coal gas for about thirty minutes, but when dealing with iron ores other than limonites, hydrogen should be employed. The contents of the bulb are then transferred to a flask, the metallic iron formed is dissolved in dilute sulphuric acid in a current of carbon dioxide, and the solution is then at once titrated with standard permanganate. L. DE K.

Use of Ammonium Nitrate in Analysis of Metals. L. Loviton (*Ann. Chim. anal.*, 1909, 14, 325).—Iron or steel coated with copper, brass, or nickel may be freed from those metals by simply immersing a few grams of the sample in ammonium nitrate in a state of fusion for a few moments. The copper, etc., will be found to be oxidised, and may be removed by washing; the iron, which is scarcely attacked, can then be weighed.

Tin and antimony also resist the action of ammonium nitrate.

L. de K.

Quantitative Precipitation of Aluminium, Chromium, and Iron. Erik Schirm (*Chem. Zeit.*, 1909, 33, 877—878).—The solution containing 0·1—0·2 gram of either of the metals is carefully neutralised with ammonia, taking care not to form a permanent precipitate, and diluted to about 250 c.c. After adding 20 c.c. of a 6% solution of ammonium nitrite, the whole is boiled in a beaker, covered with a watch-glass, until no more nitrous fumes are evolved. The precipitate formed is then washed by decantation, and collected on a filter as usual, which operation is much facilitated by the physical character of the precipitate. If the liquid should have become acid during the boiling, this should be neutralised with a few drops of ammonia. The washed precipitate is then ignited and weighed. L. de K.

The Estimation of Tungsten in Tungsten-Steel. Hugo Bartonec (*Österr. Chem. Zeit.*, 1909, [ii], 12, 114—115).—The methods usually employed for the estimation of tungsten take about two days for completion, and are considered by the author to give low results. The following processes, which were practically tested on known mixtures of tungsten, silica, and iron, can be finished in six to seven hours.

The steel (1·5—2 grams) is heated on a sand-bath with about 40 c.c. of concentrated hydrochloric acid and 10 c.c. of nitric acid. The evaporation must not be completed, as otherwise the iron is not easily eliminated. The liquid (10—15 c.c.) is diluted with four or five times its volume of water, cooled, and filtered. The residual tungstic acid and silica are dealt with by either of the following methods: (1) The precipitate is washed with hot dilute hydrochloric acid until free from iron, the tungstic acid then dissolved with warm dilute ammonium carbonate, the solution evaporated in a tared platinum crucible, and the tungsten weighed as WO_3; (2) the residue is washed with hot dilute hydrochloric acid, and then freed from the latter with 5% sodium nitrate solution to prevent the formation of colloidal tungstic acid. The precipitate is then extracted with a measured quantity of *N*/10-sodium hydroxide (about 30 c.c.), and the excess of alkali titrated with *N*/10-sulphuric acid, using phenolphthalein as indicator.

F. M. G. M.

Detection of Methyl Alcohol in Ethyl Alcohol. Anton Vorisek (*J. Soc. Chem. Ind.*, 1909, 28, 823—825).—0·5—1·0 c.c. of the alcohol or alcoholic distillate is mixed with 1 c.c. of 0·8% chromic acid solution, and diluted with water to 4—5 c.c. in a test-tube. After adding two or three small pieces of pumice, the tube is connected with an air condenser, and the contents are boiled over a small flame until 3 or 4 c.c. have been collected in a test-tube serving as receiver. The condensing tube is then rinsed with 2 c.c. of water, which are added to the contents of the receiver. To the distillate are added 1 drop of 0·4% ferric chloride solution and 2 drops of albumin solution (white of one egg beaten up with 50 c.c. of water and 2 drops of chloroform for preserving purposes), and, after mixing 4—5 c.c. of sulphuric acid free from nitric compounds, are carefully and slowly poured down the side of the tube, and the zone of contact is then observed. If methyl alcohol is present in the sample, formaldehyde will have been formed, and a violet coloration is obtained either at once or in a few minutes (Hehner's test). L. de K.

The Sabatier-Senderens Test for Distinguishing between Primary, Secondary, and Tertiary Alcohols. G. B. Neave (*Analyst*, 1909, **34**, 346—348).—The process (Abstr., 1905, i, 254) consists in passing the vapour of the alcohol over finely divided copper at 300°. Primary alcohols yield hydrogen and aldehydes, secondary alcohols, hydrogen and ketones, and tertiary alcohols, water and unsaturated hydrocarbons.

The author having experimented with 30 different alcohols, has fully confirmed the value of the test. L. de K.

Is Formaldehyde Produced by Boiling Solutions of Sucrose? Charles H. LaWall (*Amer. J. Pharm.*, 1909, **81**, 394—396).—A. A. Ramsay's statement (Abstr., 1908, ii, 994) that boiling solutions of sucrose give off appreciable quantities of formaldehyde is incorrect. Ramsay relied entirely on Hehner's milk-sulphuric acid test, and thus mistook for formaldehyde the furfuraldehyde which is produced when sucrose solutions are boiled. In testing for formaldehyde, the Rimini test with phenylhydrazine hydrochloride and sodium nitroprusside should be used; furfuraldehyde was detected with aniline acetate. G. B.

Copper Reagents and Estimation of Sugars; Copper Lactate Reagent. C. Carrez (*Ann. Chim. anal.*, 1909, **14**, 332—338).—After trying unsuccessfully to replace the tartaric acid in the Fehling solution by some other organic acids and some of the higher alcohols, the author has succeeded by using lactic acid. The new solution is prepared as follows: 180 grams of lactic acid (D 1·21) are diluted with 200 c.c. of water, and 200 c.c. of aqueous sodium hydroxide (D 1·332) are added. After boiling for a few minutes, the solution is carefully neutralised by either more alkali or lactic acid and allowed to cool, when a cold solution of 34·63 grams of copper sulphate in 250 c.c. of water is added, and the whole is then made up to 1 litre. When required for use, 10 c.c. are mixed with 15 c.c. of aqueous sodium hydroxide (80 grams per litre), 5 c.c. of 5% potassium ferrocyanide solution, and not more than 30 c.c. of water, if any (Bonnans's titration process).

As the degree of alkalinity is of great influence, it is advisable that the reducing power of the liquid should be specially ascertained;

a solution of pure dextrose (3 grams per litre) is recommended. The time of boiling also greatly influences the result, but when working under strictly equal conditions, the method gives good results in practice. L. DE K.

Estimation of Lactose in Milk by Michaelis and Rona's 'Iron Method." KARL OPPENHEIM (*Chem. Zeit.*, 1909, **33**, 927—928).—Ten c.c. of the sample are diluted with 13 c.c. of water, and 7 c.c. of colloidal ferric hydroxide are added. The liquid is passed through a dry filter, and the lactose is then estimated polarimetrically. L. DE K.

Detection of Raffinose in Plants; its Presence in Two Leguminous Seeds. ÉMILE BOURQUELOT and M. BRIDEL (*Compt. rend.*, 1909, **149**, 361—364; *J. Pharm. Chim.*, 1909, [vi], **30**, 162—167).—The solution is hydrolysed successively with invertin and melibiase; a reduction in the rotatory power indicates the presence of raffinose. The action of the melibiase will, however, be more or less marked if the raffinose is accompanied by a lævo-glucoside which is hydrolysed by invertin.

Raffinose was found to be present in seeds of *Erythrina fusca* and *Entada scandens.* N. H. J. M.

Estimation of Dry Wine Extracts. G. PATUREL (*Ann. Chim. anal.*, 1909, **14**, 329—332).—Twenty c.c. of the sample are placed in a glass evaporating dish, 55 mm. in diameter and 22 mm. in height, and evaporated on a water-bath at a temperature not exceeding 55°. After about two hours and a-half, when the residue occupies about 0·3—0·5 c.c., the dish is inclined in several directions in order to spread the mass equally over the bottom, and the rest of the moisture is then removed by drying in a desiccator over sulphuric acid. After twenty-four hours, the residue is weighed. L. DE K.

Colour Reaction of Cholic Acid and Dilute Hydrochloric Acid. OLOF HAMMARSTEN (*Zeitsch. physiol. Chem.*, 1909, **61**, 495—498).—If powdered cholic acid is shaken with 25% hydrochloric acid at room temperature, and kept, the fluid becomes yellow or yellowish-green; after four to eight hours, it is more or less bluish-violet, and after twenty-four hours, a deep bluish-violet. On further standing after filtering, it deposits a flocculent, yellowish-white precipitate, which can be collected, and twenty-four hours later another precipitate forms, and this can be repeated, the fluid ultimately becoming bluish-green with a reddish tint by transmitted light and, finally, yellow. This bluish-violet solution gives a strong absorption band near the *D*-line. The various changes are accelerated by warming. The reaction is delicate, but is not a general test for bile acids, or even for all cholic acids.

W. D. H.

Quantitative Estimation of Glycuronic Acid in Urine by the Furfuraldehyde-Hydrochloric Acid Distillation Method. CARL TOLLENS (*Zeitsch. physiol. Chem.*, 1909, **61**, 95—111).—The method is based on that of B. Tollens (Abstr., 1908, ii, 74). The

Free Nicotine in Tobacco Smoke. JULIUS TÓTH (*Chem. Zeit.*, 1909, 33, 866—867).—The smoke derived from 300 ordinary cigars yielded 8·786 grams of free organic bases, calculated as nicotine, and 0·661 gram of nicotine in combination with organic acids; therefore, 93% of the total organic bases found existed in the free state.

The total nicotine was estimated by means of the author's ether-benzene method after liberating the alkaloid with sodium hydroxide. The free nicotine was estimated in the same manner, no alkali being employed. L. DE K.

Methods of Rendering Adrenaline and Catechol Reactions more Delicate. GUSTAV BAYER (*Biochem. Zeitsch.*, 1909, 20, 178—188).—The green coloration of catechol solution produced by ferric chloride is changed to a reddish-brown colour in the presence of aromatic amino-sulphonic acids, and becomes more intense. Thus in the presence of sulphanilic acid the reaction for adrenaline is ten times as sensitive as with ferric chloride alone. The reactions for adrenaline with iodic acid (Fränkel and Allers, this vol., ii, 628) and with sodium dichromate are also rendered more delicate, but at the same time less specific.

The formation of adrenaline when putrid meat is added to minced adrenal gland, which Abelous, Soulié, and Toujan (*Compt. rend. Soc. Biol.*, 1905, 57, 301, 589) regarded as taking place, is in reality simulated by an increase in the delicacy of the iodine reaction for adrenaline employed by these authors, which increase is due to certain protein fission products present in the putrid meat (compare Barger and Walpole, this vol., ii, 416). G. B.

Quantitative Estimation of Cantharidin. L. E. WALBUM (*Pharm. Zentr.-h.*, 1909, 50, 661—664).—A modification of the Baudin method (*J. Pharm. Chim.*, 1888, 18, 391), the results agreeing fairly well with those obtained by the new process of Self and Greenish. The 15 c.c. of carbon disulphide used by Baudin are utterly insufficient to remove the fat from the cantharidin crystals. The author now uses a mixture of 70 c.c. of light petroleum of low b. p. and 50 c.c. of absolute alcohol. A correction of +0·025 gram of cantharidin should be made. The washing of the cantharidin with the solvent is much facilitated by using a centrifuge-glass instead of the double filter.

L. DE K.

Brominated Indigotins. ARTHUR BINZ and TH. MARX (*Zeitsch. angew. Chem.*, 1909, 22, 1757—1759).—The authors' object is the separation of the constituents of synthetic indigos into which halogenated indigotins have been introduced intentionally or otherwise. Three samples of synthetic indigo, containing 30—40% of bromine, have been examined. Oxidation is of little use, since inseparable mixtures of brominated isatins are produced; from these, *p*-bromoaniline is obtained by distillation with potassium hydroxide. 5-Bromoanthranilic acid is obtained by oxidation with manganese dioxide and aqueous alcoholic potassium hydroxide at 150°, two of the samples, however, yielding this acid mixed with undetermined by-products.

A successful separation is effected by extracting the sample with chloroform in a Soxhlet apparatus, whereby tribromoindigotin is dissolved. The residue is shaken with a cold mixture of glacial acetic acid (80 vols.) and concentrated sulphuric acid (20 vols.), which dissolves indigotin and bromoindigotin, but leaves dibromoindigotin almost unaffected. The presence of indigotin is detected by heating the sample with the preceding mixture of acids on the water-bath and precipitating the solution with ether; the product is hydrolysed, the precipitate weighed, and the sulphuric acid in the filtrate estimated. The method is not trustworthy, however, because the bromo- and dibromo-indigotins, which are reprecipitated unchanged, but in a colloidal state, obstinately retain sulphuric acid, which cannot be washed out completely, so that the percentage of indigotin is always too high. C. S.

Rapid Method for the Estimation of Albumin in Urine. K. BRAUNGARD (*Chem. Zeit.*, 1907, **33**, 942).—An improved Esbach tube, the bottom part of which is drawn out and provided with a scale, enabling the amount of albumin to be read off to 0·1 part per 1000.

After introducing the urine and the usual solution of citric and picric acids, the whole is centrifugalised for about two minutes and the volume of the deposit is read off. L. DE K.

Detection of Proteins in Urine. BLANC and RAMEAU (*Ann. Chim. anal.*, 1909, **14**, 204—205).—A table giving a systematic course for the detection in urine of acetic-soluble albumin, serin, globulin, ψ-albumin, propeptones, peptones, ψ-mucin, mucin, nucleo-albumins, and alkali-albumins. L. DE K.

Detection of Peptolytic Enzymes. EMIL ABDERHALDEN and ALFRED SCHITTENHELM (*Zeitsch. physiol. Chem.*, 1909, **61**, 421—425).—The change which peptolytic enzymes produce in polarisation when polypeptides are decomposed into their amino-acids is unsuitable as a general test for such enzymes; the detection of free tryptophan from a polypeptide containing it is also not free from objections. The substance best adapted for the purpose is glycyl-*l*-tyrosine, prepared from silk and known commercially as Peptone Roche. Its solution is rendered alkaline, and the extract or fluid suspected to contain an enzyme of the erepsin type is added; if such an enzyme is present, tyrosine is deposited on cooling, and its amount is a measure of the amount of enzyme. Normal gastric juice contains no such enzyme, but in some abnormal cases it is found. W. D. H.

General and Physical Chemistry.

Optical Perceptibility and Electrical Migration of Dissolved Molecules. ALFRED COEHN (*Zeitsch. Elektrochem.*, 1909, **15**, 652—654).—Water was purified by Spring's method (Abstr., 1899, ii, 537) until it was optically pure. A 0·5*N*-solution of sucrose, treated in the same way and examined in sunlight with the ultra-microscope, showed a visible cone of light. Dust particles appear as single points of light in the ultra-microscope, whilst the cone observed was quite homogeneous, and is therefore probably due to the sugar molecules.

Sucrose, when dissolved in dilute hydrochloric acid, has no effect on its conductivity, which shows that the ions are not added on to the sucrose molecules. In such solutions the sucrose always moves with an electric current towards the cathode. The author regards this as indicating that the sucrose molecules carry an electrical double layer in the same way as solid particles suspended in a liquid. T. E.

Crystallo-optical Investigations. HEINRICH BAUMHAUER (*Zeitsch. Kryst. Min.*, 1909, **47**, 1—21).—Determinations of the refractive indices for light of different wave-lengths are given for tin dioxide (artificial cassiterite), zircon, anatase, wulfenite, phosgenite, sulphur, potassium lithium platinocyanide, and rubidium lithium platinocyanide. These results, together with those previously obtained for some other substances, are plotted as curves to illustrate the difference in dispersion for the extraordinary and ordinary rays. L. J. S.

Relation between the Refractive Index and the Density of Some Crystallised Silicates and their Glasses. ESPER S. LARSEN (*Amer. J. Sci.*, 1909, [iv], **28**, 263—274).—The refractive indices and densities of certain silicate glasses and artificial minerals have been determined. The data for the glasses indicate that neither the refractive index nor the specific volume is strictly additive in character.

The specific refractivities, calculated either from the formula of Gladstone and Dale or that of Lorentz and Lorenz, are, however, sensibly additive both for the glasses and for the isomorphous series of soda-lime felspars. If the crystallised silicates are compared with glasses of the same composition, the valuos of the specific refractivity are found to differ considerably, the deviation amounting to as much as 11%. H. M. D.

Application of the Formulæ of Pulfrich and Hess to Mixtures of Ethyl Alcohol and Water. ANTONY G. DOROSCHEWSKY and S. V. DVORSCHANTSCHIK (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 849—855.* Compare Abstr., 1908, ii, 241, 785).—Hess (this vol., ii, 1) gives the following generalised form to Pulfrich's equation (*Zeitsch. physikal. Chem.*, 1889, **4**, 561) representing the relation between the refraction of a mixture of liquids and its contraction: $(R - R_v)/R = qc$, where R_v is the calculated refraction of the mixture, R the actual refraction, c the amount of contraction $[(D - D_v)/D]$, and q is a constant for any one binary mixture and is indicated by α, β, or γ, according as the refraction is expressed in the form $n - 1$, $(n^2 - 1)/(n^2 + 2)$, or $n^2 - 1$. Hess's statement that the values of α, β, and γ are practically independent of the temperature is contradicted by his own numbers for these constants at different temperatures (thallium light):

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* and *Zeitsch. physikal. Chem.*, 1909, **68**, 43—48.

	15°.	20°.	25°.	30°.
α	0·977	0·900	0·881	0·854
β	0·885	0·821	0·798	0·774
γ	1·117	1·032	0·992	0·975

The authors show that these numbers, when employed to calculate the compositions of alcohol-water mixtures at different temperatures, yield results exhibiting considerable divergence among themselves. Determinations of the values of β and γ for the *D*-line, and for mixtures containing from 10 to 90% of alcohol, at 15°, 20°, and 25° give the following mean and limiting numbers: β, 0·882 (0·871—0·897); γ, 1·112 (1·100—1·133).

Calculations made with these mean values and with the mean value previously obtained for α (Abstr., 1908, ii, 785) give results in close approximation to the truth. Gladstone's refraction formula is to be preferred to the other two, owing to its greater simplicity and to the somewhat greater accuracy of the results to which it leads.

T. H. P.

Molecular Refractions of Esters of Imino-acids and their Nitroso-derivatives. George L. Stadnikoff (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 909—920).—The feebly basic character of the imino-acids, which is explainable by the proximity of two carboxyl groups to the imino-group, also finds expression in the molecular refractions of the esters of these acids. The experimental values for these refractions are considerably less than the values calculated from the atomic refractions, the value taken for nitrogen being that found by Brühl (Abstr., 1895, ii, 194) for secondary aliphatic amines; the influence of the carboxyl groups in this direction diminishes as the distance of these groups from the imino-group increases. These results are in complete harmony with that of Brühl (Trans., 1907, **93**, 115), who found that union of amino-nitrogen with electronegative radicles conditions a depression in the molecular refraction. For aliphatic imino-acids, this depression is constant, the mean value being 0·64, but for esters of aromatic iminodiacetic acids the depression is considerably less than 0·64, so that the experimental and calculated molecular refractions differ only slightly; it may be that this diminution of the depression is due to the increase of molecular weight, as was observed by Nasini and Carrara (Abstr., 1894, ii, 302) for pyrrole, furan, thiophen, and their homologues.

The author's measurements of the refractions of esters of imino-acids and of the nitroso-derivatives of these esters show that the atomic refraction of nitrogen does not remain constant even for one and the same class of organic compounds, but varies between fairly wide limits.

The numerical results obtained are as follows; the depression of the molecular refraction below the calculated value is indicated by Δ.

Dimethyl iminodiacetate, $NH(CH_2{\cdot}CO_2Me)_2$, D_4^{13} 1·1732, n^{13} 1·4415, Δ = 0·66. Diethyl ester, D_4^{20} 1·0805, $n^{18·5}$ 1·4365, Δ = 0·60; its *nitroso*-derivative, $NO{\cdot}N(CH_2{\cdot}CO_2Et)_2$, b. p. 164—165°/15 mm., D_4^{20} 1·1684, n^{20} 1·4527, Δ = 0·28. Dibutyl ester, D_4^{18} 1·0086, n^{18} 1·4405, Δ = 0·63.

Dimethyl *C*-methyliminodiacetate, $D_4^{12·5}$ 1·1160—1·1245, $n^{19·5}$ 1·4369, Δ = 0·72; its *nitroso*-derivative, b. p. 180—181°/28 mm., D_4^{15} 1·2293, $D_4^{6·5}$ 1·2383, n^{19} 1·4598, Δ = 0·50. Diethyl ester, D_4^{20} 1·0467, D_4^{13} 1·0527, n^{21} 1·4320, Δ = 0·58; its nitroso-derivative, D_4^{20} 1·1409, D_4^{14} 1·1462, n^{21} 1·4513, Δ = 0·46.

Diethyl C-*ethyliminodiacetate* is a colourless liquid, b. p. 132°/14 mm., D_4^{20} 1·0353, n^{20} 1·4360, Δ = 0·71; its *nitroso*-derivative, a viscous, yellow liquid, b. p. 173°/16 mm., D_4^{22} 1·1169, n^{22} 1·4516, Δ = 0·49.

Diethyl *C*-*iso*butyliminodiacetate, D_4^{20} 0·9997, n^{20} 1·4362, Δ = 0·61; its nitroso-derivative, D_4^{19} 1·0807, $n^{19·5}$ 1·4520, Δ = 0·67.

Diethyl *α*-propio-*β*-iminobutyrate, D_4^{19} 1·0072, D_4^{27} 1·0002, n^{18} 1·4326, Δ = 0·61; its nitroso-derivative, D_4^{19} 1·1135, D_4^{25} 1·1082, n^{21} 1·4563, Δ = 0·86.

Diethyl *sym.*-*CC*-dimethyliminodipropionate, D_4^{18} 1·0028, D_4^{27} 0·9950, n^{20} 1·4380, Δ = 0·43.

Dimethyl *C*-phenyliminodiacetate, b. p. 220—221°/17 mm. (Stadnikoff, this vol., i, 106, gave 188—189°/17 mm.), D_4^{16} 1·1705, D_4^{25} 1·1622, n^{18} 1·5111, Δ = 0·38. Diethyl ester, D_4^{20} 1·1059, n^{20} 1·4976, Δ = 0·15.

Diethyl *sym.*-*C*-phenyl-*C*-methyliminodiacetate, D_4^{16} 1·0811, D_4^{24} 1·0730, n^{19} 1·4899, molecular refraction 74·89 (found), 74·99 (calc.).

Trimethyl iminotriacetate, $N(CH_2{\cdot}CO_2Me)_3$, is a colourless, viscous liquid, b. p. 167°/13 mm., $D_4^{16·5}$ 1·2130, $D_4^{27·5}$ 1·2018, n^{20} 1·4500, Δ = 1·43. Triethyl ester, b. p. 184°/17 mm. [Heintz, *Annalen*, 1866, **140**, 264, gave 280—290° (decomp.)], $D_4^{16·5}$ 1·1118, $D_4^{9·5}$ 1·1182, $n^{19·5}$ 1·4440, Δ = 1·14.

T. H. P.

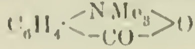
Influence of the Medium on the Lines of Spark Spectra. HEINRICH FINGER (*Zeitsch. wiss. Photograph. Photophysik. Photochem.*, 1909, 7, 369—392).—The experiments given in a previous paper (compare this vol., ii, 774) are discussed in full detail. Comparison of the spectra of the spark discharges in water and air between electrodes made of different metals shows that the air spectrum, which is always formed with spark discharges in air, is missing when water is the medium. In its place there is a more or less extended continuous spectrum, in which the position of the maximum varies with different elements. In many cases, but not in all, the water vapour spectrum occurs together with the continuous spectrum, but the lines are reversed. The lines of the ordinary spark spectra are affected in different ways. Some are missing, some are reversed, others self-reversed, while still others are broadened symmetrically or on one side only; in many cases there is a combination of these effects. In some cases, for example, tantalum, the spark spectrum under water is exactly the same as in air. These changes do not depend on the form and position of the electrodes, the same spectrum being always obtained when electrodes of pure metal are used. In the case of alloys, other reversal phenomena occur.

In none of the spectra do the lines of hydrogen or oxygen, which gases are always formed during the discharge, or of the salt dissolved in the water, occur. The water used was that of the ordinary town supply. In a 1% solution of sodium chloride, however, with iron electrodes the sodium lines could be seen with the naked eye, although very weak. With stronger solutions the increased conductivity of the water diminished the intensity of the spark discharge, and hence of the spectrum; nevertheless, the characteristic changes in the spectral lines seem to be independent of the nature of the medium, which may be either distilled water, ordinary water, a solution of sodium chloride, or a solution of barium chloride.

A consideration of all the observed phenomena shows that the question of spark discharges under water is extremely complicated, so that at present no adequate explanation can be given. The phenomena are different in character from those obtained in spark discharges through gases at high pressures. T. S. P.

Behaviour of Ice in the Ultra-Red Spectrum. GÜNTHER BODE (*Ann. Physik*, 1909, [iv], 30, 326—336).—The great difference between the values of the dielectric constants of ice and water indicates a corresponding difference in the refractive indices for infinitely long waves, and this has led the author to examine the behaviour of ice towards ultra-red radiation. Measurements were made of the radiation absorbed by thin plates, and also of that reflected from the surface of a block of ice cooled down to about −10°. For wave-lengths between 1 and 6μ, the same absorption maxima are found as in the case of water, and anomalous reflexion is exhibited in the same region. H. M. D.

Constitution of Amino acids. HEINRICH LEY and M. ULRICH (*Ber.*, 1909, 42, 3440—3449).—The fact that the limits of absorption in the aniline bases are shifted by salt formation away from the less refrangible part of the spectrum owing to the diminution in the unsaturation of the amino-group by salt formation (Hartley, Baly, and Collie, Trans., 1905, 87, 1332, 1822) is illustrated also when the amino is converted into a quaternary ammonium salt. The ultra-violet absorption spectrum of phenyltrimethylammonium chloride is the same as that of aniline hydrochloride in the regions of continuous absorption and differs, where selective absorption is observed, only in giving one broad band instead of many small bands.

The transparency of an aromatic amino-compound is also increased by internal salt formation. From a comparison of the absorption spectra of methyl dimethylanthranilate, $NMe_2\cdot C_6H_4\cdot CO_2Me$, and *o*-benzbetaine,  $C_6H_4\cdot<\begin{matrix}NMe_3\\-CO-\end{matrix}>O$, the conclusion is drawn that if an acid and its ester give the same spectrum, the former has an "open" structure, whilst if the acid is more transparent than the ester it exists as an internal salt of betaine-like character. Instances of the first kind are anilinoacetic acid and its ethyl ester, and methylanthranilic acid and its methyl ester. Examples of the second kind are dimethylanthranilic acid and its methyl ester, and piperidinoacetic acid and its ethyl ester. C. S.

Ultra-violet Absorption, Fluorescence, and Magnetic Rotation of Sodium Vapour. ROBERT W. WOOD (*Phil. Mag.*, 1909, [vi], 18, 530—535. Compare this vol., ii, 106).—By making use of a larger quartz spectrograph, the Balmer series of double lines has been increased from thirty to forty-eight, the wave-lengths of which are tabulated. The higher members of the series make their appearance as the density of the sodium vapour is increased, and simultaneously the lower members are obliterated by channelled spectra which accompany them. These channelled spectra are analogous to that which accompanies the *D*-lines, but the constitution of the former is somewhat different, in that they are spread out in both directions above and below the lines which they accompany.

There appears to be no connexion between the mechanisms which produce the *D*-lines and the visible channelled spectra, on the one hand, and the ultra-violet double lines, on the other. The evidence seems to show that the different lines of the Balmer series and their accompanying channelled spectra are produced by different entities, and it is suggested that these are atoms which have lost one, two, three, four, etc., electrons.

A determination of the magnetic rotation at the first two ultra-violet members of the Balmer series shows that this is in the same direction as at the *D*-lines. H. M. D.

Phosphorescence of Organic Substances at Low Temperatures. J. DZIERZBICKI and JOSEPH DE KOWALSKI (*Bull. Acad. sci. Cracow*, 1909, 724—731; *Arch. sci. phys. nat.*, 1907, [iv], 28, 227—236). —In the experiments described, the presence of a very small percentage of impurity affects the results, consequently only dilute alcoholic solutions are used. The solutions are cooled by liquid air, exposed for fifteen seconds to the light of a mercury-vapour lamp, and the intensity and persistence of the phosphorescence examined by an untired eye. Aromatic hydrocarbons and their di-substituted derivatives containing halogen atoms and hydroxyl, methoxy-, amino-, nitro-, and carboxyl groups have been examined. In all cases the para-isomeride exhibits the greatest intensity and persistence, the meta- and the ortho-derivatives following, usually in this order.

Experiments on solutions of benzene, toluene, and the xylenes show that the introduction of a methyl group into the benzene nucleus increases the intensity of the phosphorescence, and that the entrance of a second methyl group causes a further increase only when the group enters the para-position; mesitylene and ψ-cumene are more phosphorescent than *p*-xylene. Similar remarks are true of benzene, aniline, and the toluidines.

The entrance of chlorine into the aniline molecule diminishes the intensity, and most when it enters the para-position.

Comparing benzene, toluene, aniline, and phenol, it appears that the amino-group is most effective in increasing the intensity of the phosphorescence, being followed in order by the hydroxyl and the methyl groups; as regards persistence, the toluene solution has the longest persistence, followed by those of benzene, aniline, and phenol.

C. S.

Optical Activity and the Product of Asymmetry. J. Wallace Walker (*J. Physical. Chem.*, 1909, 13, 574—584).—Bose and Willers (this vol., ii, 361) have recently stated that, using the Crum-Brown formula for the asymmetry product,

$$M[\alpha] = (C_1 - C_2)(C_1 - C_3)(C_1 - C_4)(C_2 - C_3)(C_2 - C_4)/(C_3 - C_4),$$

it is possible to find values for the activity constants C_1, C_2, C_3, and C_4 of the groups which admit of the calculation of the molecular rotation with a moderate degree of accuracy. Some years ago the author made an unsuccessful attempt to prove the validity of Crum-Brown's formula by choosing various values for the constants, and now shows by a mathematical method that it is not possible to assign rotation equivalents to all radicles, from which the molecular rotations of the substances containing them may be calculated by Crum-Brown's equation.

If eight optically active substances all possess one common radicle, and the other radicles are chosen from a group of six, a certain relationship must hold between the numerical values of the respective molecular rotations provided that rotation equivalents can be assigned to each. Substances fulfilling these requirements are the methyl and ethyl esters of lactic, mandelic, chloropropionic, and chlorophenylacetic acids. They have been carefully prepared, and the molecular rotation measured at a series of temperatures between 10° and 70°. By using these numbers it is shown that the mathematical relationship referred to above does not hold, and therefore that no single rotation equivalent can be assigned to each radicle.

The values of the molecular rotation are as follows: Methyl lactate, −796 at 20°, −966 at 70°; ethyl lactate, −1216 at 20°, −1434 at 70°; methyl mandelate, −27590 at 20°, −23820 at 70°; ethyl mandelate, −22570 at 20°, −19710 at 70°; methyl chloropropionate, +2888 at 20°, +2524 at 70°; ethyl chloropropionate, +2576 at 20°, +2207 at 70°; methyl chlorophenylacetate, +7002 at 20°, +5978 at 70°; ethyl chlorophenylacetate, +6622 at 20°, +5571 at 70°. Many of the results are not in satisfactory agreement with those of Walden (Abstr., 1895, i, 450; 1896, i, 139).

G. S.

Photochemical Equilibrium of Hydrogen Chloride. Alfred Coehn and Alexandra Wassiljewa (*Ber.*, 1909, 42, 3183—3186).—The equilibrium point of hydrogen chloride in the dark lies practically at the point of complete formation of this compound from its elements. This equilibrium can be brought about in the absence of light by submitting the mixture of hydrogen and chlorine to the catalytic action of charcoal. Hitherto the question has not been investigated as to whether hydrogen chloride is decomposed into its elements to any extent under the action of light.

The authors find that if pure hydrogen chloride is submitted to the action of ultraviolet light from a mercury-quartz lamp, it is split up to such an extent that, on collecting the gases over a solution of potassium iodide, about 2 c.c. of hydrogen are produced in a quarter of an hour. The hydrogen chloride was passed through a quartz tube, which was at a distance of about 2 cm. from the lamp, and the tubing through which the gases were led away from the quartz tube was protected from all light. If the quartz tube was replaced by one made of ordinary glass or of Uviol glass, no decomposition of the hydrogen chloride took place.

The constant for the photochemical equilibrium is

$$k = ([H_2][Cl_2])/[HCl]^2 = 6{\cdot}25 \times 10^{-6}.$$

Details are reserved for a further communication. T. S. P.

Electrochemistry of Light. VIII. Wilder D. Bancroft (*J. Physical Chem.*, 1909, 13, 538—573. Compare this vol., ii, 454, 632).—The paper deals mainly with photographic reversals, when both a positive and a negative image occur on the plate. The work of Waterhouse, Guébhart, Kogelmann, Homolka, Carey Lea, and others is discussed at length, and in many cases their observations are explained on the author's theory of reversal.

Waterhouse has shown that the addition of thiocarbamide to the developer produces reversal, and the author shows that both the positive image as well as the negative image consists of silver, and not of silver sulphide as might perhaps be expected. For this and other reasons it is suggested that the thiocarbamide renders the unexposed silver bromide relatively more sensitive than the exposed bromide, the positive image being therefore the more dense. This view is supported by the fact that the process can be divided into two stages. If an exposed plate is dipped into a solution of thiocarbamide alone, the emulsion is ripened, and when the plate is washed and then immersed in an ordinary developer, a positive is obtained. The Guébhart reversal can be accounted for on similar lines, the sensitising agent in this case being sodium sulphite. Some special cases of retarded development are discussed in detail.

Carey Lea's apparent reversals with dilute, but not with concentrated, sodium hypophosphite are due to the fact that the hypophosphite acts both as a reducing agent and as a solvent for silver bromide. If the immersion is comparatively short, the reducing action is the more important, and the treated portion develops dark. G. S.

Reduction of Ferric Chloride by the Light of the Mercury Vapour Lamp. Alfred Benrath (*J. pr. Chem.*, 1909, [ii], 80, 283—287).—It has been shown previously (Abstr., 1905, i, 730) that methyl alcoholic ferric chloride is reduced in sunlight, ferrous chloride, hydrogen chloride, and formaldehyde being the primary products, whilst methyl chloride and formaldehyde hydrochloride are obtained by secondary reactions.

If the light acts merely as a catalyst, the velocity of the reaction should be proportional to the concentration. Experiments on methyl or ethyl alcoholic solutions of ferric chloride in quartz vessels of 1·3 cm. diameter, placed 12 cm. from a 110-volt. mercury vapour lamp, show, however, that the quotient t/c (where c is the concentration of the solution and t the time required for its decolorisation) is nearly constant, proving that the amount of light energy required to reduce a definite quantity of ferric chloride is nearly constant and independent of the concentration. The light acts, therefore, not as a catalyst, but as an actual generator of chemical energy. It follows that the reduction of the ferric chloride must proceed more rapidly the narrower the containing vessel; this is proved experimentally.

A method of determining the change of concentration of the solution after a definite exposure to the light is based on the fact that the change of the density of a reacting mixture is proportional to the change of concentration of the reacting substances. A 3% solution of ferric chloride in ethyl alcohol or a 4% solution in methyl alcohol is, exposed to the mercury vapour light for definite intervals of time t, and the density of the system is also determined; it is found that $\Delta \times 10^7/t$ is practically constant (Δ representing the change of density). C. S.

Effect of Temperature on the Photodynamic Action and the Action of Light on Invertase. B. Hannes and Alb. Jodlbauer (*Biochem. Zeitsch.*, 1909, 21, 110—113).—Solutions of invertin were exposed to sunlight from which the heat rays were eliminated, with and without addition of eosin, at 10° and 30°. It was found that the increased temperature (20°) produced exactly the same amount of injury in both cases, the percentages being 11·2 and 36·1 at 10°, and 12·6 and 40·6 at 30°. N. H. J. M.

Radioactive Minerals in Common Rocks. J. W. Waters (*Phil. Mag.*, 1909, [vi], 18, 677—679).—Experiments have been made to determine in what minerals the radioactivity of igneous rocks is most concentrated. Cornwall granite, from which kaolin and mica had been previously removed, was fractionated by means of bromoform, and afterwards by means of a magnet. The radioactivity was found to be chiefly concentrated in a small fraction which spectroscopic examination indicated to be anatase or rutile.

Similar methods applied to a gneiss from the Inner Hebrides showed that the activity was concentrated in a very heavy, non magnetic mineral occurring in very small crystals, which proved to be zircon. H. M. D.

Radioactivity of Certain Lavas. John Joly (*Phil. Mag.*, 1909, [vi], 18, 577—586).—The radioactivity of Vesuvian and other lavas has been measured, and the proportions of radium and thorium which they contain are tabulated. The values of the radioactivity of Vesuvian lavas from 1631 up to the present day are abnormally high, and appear to show a progressive increase according as they are of more recent eruption. The value obtained for a very old leucitic rock from the prehistoric eruption of Monte Somma was less than the normal for igneous rocks. The progressive increase in radioactivity suggests that, as time progresses, materials richer and richer in radium are being tapped. This may very well be the case in spite of the fact that the lavas have shown a remarkable constancy in chemical composition from the earliest times.

The question as to the connexion between radioactivity and vulcanicity is discussed, and an estimate is made of the intrinsic heating effect of the lavas on the basis of their content of radioactive materials. From the mean radium and thorium content of the Vesuvian lavas ejected since 1631, it is calculated that a rise of temperature of about 150° in one million years is produced, assuming no loss by conduction. H. M. D.

The Radioactive Elements. II. DANIEL STRÖMHOLM and THE SVEDBERG (*Zeitsch. anorg. Chem.*, 1909, 63, 197—206. Compare this vol., ii, 200).—Of the actinium series, actinium-*X* belongs to the alkaline earth group, being isomorphous with barium. Actinium itself is isomorphous with lanthanum, and radioactinium with thorium.

Attempts which have been made to determine the coefficient of distribution of radioactive elements between crystals of barium nitrate and the mother liquor, indicate that the coefficient is constant over a considerable range of concentration, and is the same for thorium-*X*, actinium-*X*, and radium.

In the thorium, actinium, and radium series, the element immediately preceding the emanation is an alkaline earth metal. Before this comes an element isomorphous with thorium. A modification of the periodic table is suggested, in which the three radioactive series are arranged parallel with one another in the sixth period. C. H. D.

Complex Nature of Radium-*C*. OTTO HAHN and LISE MEITNER (*Physikal. Zeitsch.*, 1909, 10, 697—703).—Measurements have been made to ascertain whether the β-rays emitted by disintegration products of radium are homogeneous or not.

From a solution of the active deposit, radium-*C* is completely removed by repeated treatment with animal charcoal, and radium-*B* precipitated by means of barium sulphate. The absorption of the β-rays of the freshly prepared material by aluminium indicates that these rays are homogeneous. By the same process it is found that the β-radiation of radium-*C* is nonhomogeneous, and the conclusion is drawn that radium-*C* consists of two or more substances. By investigation of the decay curves of the radium-*C*, obtained by collecting the particles of matter set free when β-rays are expelled from radium-*B*, this conclusion is confirmed. The half-decay periods of the products obtained vary between one and 2·5 minutes, so that radium-*C* consists of at least two substances, radium-C_1 and radium-C_2. There is also some evidence that the latter is complex, one of its components having a period of a few seconds, the other a period of two to 2·5 minutes.

H. M. D.

Action of Radium Emanation on the Elements of the Carbon Group. Sir William Ramsay and Francis L. Usher (*Ber.*, 1909, **42**, 2930—2931. Compare Trans., 1909, **95**, 624).—Solutions of different salts of the carbon group of elements have been submitted to the action of radium emanation, which was collected in one week from a solution of radium bromide containing 0·2111 gram of metallic radium. After the emanation had been carefully freed from carbon dioxide, it was introduced into an evacuated glass vessel containing the solution to be experimented on, and the whole left for four weeks. The gases were then collected and analysed, with the following results:

Solution of	Vol. of emanation, c.mm.	N_2, c.c.	O_2, c.c.	CO_2, c.c.	CO, c.c.	Oxyhydrogen gas, c.c.	H_2 c.c.
H_2SiF_6	0·0724	—	—	0·063	—	9·15	1·03
$Ti(SO_4)_2$	0·0912	0·210	—	0·054	0·096	—	0·69
$Zr(NO_3)_4$	0·0692	0·762	—	0·116	0·008	—	—
$Zr(NO_3)_4$	0·0865	0·456	—	0·124	0·002	—	—
$Th(NO_3)_4$	0·1120	3·686	—	0·551	—	—	—
$Th(NO_3)_4$	0·0765	0·639	—	0·124	—	—	—
$Pb(ClO_3)_2$	0·0649	—	2·655	0·007	0·006	2·531	—

Thus each of the elements of the carbon group, without exception, gives rise to carbon compounds under the action of radium emanation; the quantities produced are, however, not equal. It is not improbable that elements with a high atomic weight are more easily broken down than those of lower atomic weight. Lead, however, seems to be especially stable, showing little tendency to change into carbon.

Mercurous nitrate gave no trace of carbon monoxide or dioxide.

T. S. P.

Secondary Radiation of X-Rays. Paolo Rossi (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], **15**, 67—75. Compare Townsend, *Proc. Camb. Phil. Soc.*, 1899, **10**, 217).—The author finds that the fact that strata which are isotransparent for a given quality of X-rays, exercise in general different absorptions on the secondary radiations excited by them, has a marked influence on the intensity and nature of the secondary radiation leaving the radiating body. In this way can be explained, at least qualitatively, the facts that the secondary radiation is less intense but more penetrating for aluminium than for copper, and that with a thin plate of aluminium this secondary radiation is not only less copious, but also less penetrating than with a thick plate.

Marked increase of the hardness of the primary rays is accompanied by variation of the relations between the intensities of the secondary emissions of different substances, in some cases to such an extent as to change the order of these substances with respect to intensity of emission. It would appear, indeed, that the softer rays are the less active in exciting the secondary radiation of such substances, so that secondary X-rays obey a law similar to that of Stokes relative to fluorescence.

T. H. P.

Retardation of α-Rays by Metals and Gases. T. Smith Taylor (*Phil. Mag.*, 1909, [vi], **18**, 604—619.* Compare Abstr., 1908, ii, 793).—Further examination of the retarding effect of metals on α-rays has shown that for sheets of different metals of equal air equivalents, the rates at which the air-equivalents decrease with the speed of the α-particles are approximately proportional to the square roots of the respective atomic weights. The air equivalents of hydrogen layers increase as the speed of the entering particles decreases, whilst the air-equivalents of sheets of paper and celloidin remain constant. On the other hand, the hydrogen-equivalents of paper, celloidin, and air decrease as the speed of the α-particles decreases.

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* and *Amer. J. Sci.*, 1909, [iv], **28**, 357—372.

The observation, made by Bragg, that the total ionisation produced by the α-particle is the same in air and hydrogen, is confirmed by a more direct method. It seems probable that for large ranges the α-particle loses its energy more rapidly the higher the atomic weight of the substance through which it passes; this difference diminishes, however, and for low ranges the loss of energy is the more rapid the lower the atomic weight of the substance. A comparison of the Bragg curves for air and hydrogen indicates that the large ionisation at low ranges is due to some extent to the fact that the particle loses its energy more rapidly in this part of the range. H. M. D.

γ-Rays of Uranium and Radium. Frederick Soddy and Alexander S. Russell (*Phil. Mag.*, 1909, [vi], 18, 620—649. Compare this vol., ii, 460).—A comparison of the γ-radiations of uranium-*X* and of radium has been made, and from the results the conclusion is drawn that the β- and γ-radiations are probably not interdependent. The ratio of the β- to the γ-rays of uranium-*X* is 62 when the same ratio for radium-*C* is taken as unity, the rays in each case being measured through 1 cm. of lead. When the absorption in the lead is allowed for, the value of the ratio for uranium is 50. The ratio for uranium is only 18 when the rays are measured through 0·6 cm. of aluminium, so as to admit any soft γ-radiation if present.

For thicknesses less than 1 cm. of lead or its equivalent, the absorption of the γ-rays of uranium does not follow any simple law. For greater thicknesses the absorption is exponential, and is proportional to the density of the absorbing material. The value of λ/d for all but the heaviest and lightest substances was found to be 0·047 for uranium and 0·040 for radium, the ratio being 1·18. Lead appears to behave abnormally, and the value of λ/d is 0·0636 for uranium γ-rays and 0·0434 for radium γ-rays, the ratio being 1·465.

The initial γ-radiation of that amount of uranium-*X* which is in equilibrium with one kilogram of uranium was found to be equal to that of 0·015 mg. of a sample of a radium compound containing 66·6% of radium. H. M. D.

Absorption of Uranium-*X* by Charcoal. Albert Ritzel (*Zeitsch. physikal. Chem.*, 1909, 67, 724—761).—The measurements were made with solutions of uranium nitrate varying in concentration from *N*/10 to *N*. As the uranium was in radioactive equilibrium with uranium-*X*, the concentration of the solutions with reference to the latter was known. A method is described for estimating the amount of uranium-X in a solution by measuring the β-radiation with an electroscope in the usual way.

When charcoal is shaken with a solution containing uranium-X the latter is taken up by the charcoal, at first rapidly, then more slowly, and equilibrium is only attained after shaking for about ten days. At equilibrium, the amount taken up by the charcoal, C_s, is proportional to that in the solution, C_l. It is considered that uranium-X is at first adsorbed on the surface of the charcoal, and then slowly diffuses into it. The magnitude of the ratio $C_l : C_s$ is the smaller the smaller the concentration of the uranium nitrate solution, and also depends on whether other radioactive substances besides uranium-X are present in solution.

Experiments have also been made on the partition of uranium-X between charcoal and solutions containing no uranium. For solutions of hydrochloric, nitric, and sulphuric acid, equilibrium is reached in a few hours, and the equation holds: $C_l = \text{const.}(C_s - k)$, where k is a constant. Uranium-X is also absorbed by alkalis, but not by water, salt solutions, or ether. In these respects it behaves just like the decomposition products of thorium investigated by von Lerch (Abstr., 1904, ii, 8). G. S.

Ionium. BRUNO KEETMAN (*Jahrb. Radioaktiv. Elektronik.*, 1909, 6, 265—274).—The production of very active preparations of ionium from the residues obtained in working up uranium ores containing but little thorium is described. On addition of hydrofluoric acid to the strongly acid solution of the raw material, a mixture of fluorides of the rare earths, calcium and uranium, together with about 0·25% of thorium, is obtained. The fluorides are converted into sulphates, and from the aqueous solution of these, ionium and thorium are separated quantitatively by means of precipitated zinc hydroxide. The strongly acid solution of the precipitate is then treated with oxalic acid, when ionium thorium oxalate is thrown down. From 500 kilograms of raw material, 140 grams of the oxalate were obtained, with an activity 200 times as large as that of metallic uranium. Although a large number of methods were tried, it was not found possible to separate the ionium from the thorium.

The rate of formation of radium from ionium was determined with the above material, and the observations give 1800 years for the life of radium. This is in good agreement with the value given by Rutherford and Geiger.

Ionium was detected in a sample of uranyl ammonium carbonate prepared by Rammelsberg. Since the exact date of the preparation of this material is not known, the determined amount of ionium cannot be used to deduce accurately the life of ionium. The data indicate, however, that this is several thousand years.

The relationship of actinium to ionium has been examined, and, as a result, it is proved that actinium is not a direct product of the transformation of ionium.

By reason of its high and very constant activity, ionium-thorium oxalate is recommended as a suitable substance for testing the constancy of electrometers and for determining capacities. H. M. D.

Escape of Negative Electrons from Reacting Metals. FRITZ HABER and G. JUST (*Ann. Physik*, 1909, [iv], 30, 411—415).—Experiments are described which show that negative electrons are given off by the alkali metals when these undergo oxidation in moist air. If the liquid alloy of sodium and potassium, contained in an insulated vessel, is connected with the negative pole of a high potential battery, and a metal disk, connected with an electroscope, is placed above the alloy at a distance of a few centimetres, it is found that the electroscope becomes negatively charged when the surface of the alloy is disturbed so as to expose the unaltered metals to the action of the air. When the alloy is connected with the positive pole of the battery, the electroscope is unaffected. Experiments in hydrogen and dry air gave no result.

The employment of an electrical field to remove the negative electrons from the surface of the oxidising metal is not essential. This can also be effected by passing a current of dry air over the freshly exposed surface. From this observation the authors draw the conclusion that the electrons move with small velocity. Apart from this small velocity of the emitted electrons, the reaction effect is very similar to the photo-electric effect. H. M. D.

Kinetic Energy of the Positive Ions Emitted from Various Hot Substances. F. C. BROWN (*Phil. Mag.*, 1909, [vi], 18, 649—672. Compare this vol., ii, 368).—Measurements have been made of the kinetic energy of the positive ions emitted by gold, silver, palladium, tantalum, nickel, platinum, osmium, tungsten, iron, and aluminium phosphate at high temperatures.

The radiating surface of from 0·2 to 0·3 sq. mm. area was located in the centre of a disk of 13 mm. diameter, and the ions emitted impinged on a parallel disk less than 1 mm. distant. Different potentials were applied to the parallel disc, and the corresponding thermo-ionic currents were determined.

The experimental data indicate that the mean kinetic energy of the positive thermo-ions emitted from hot substances is independent of the material from which the ions are emitted, and varies directly as its absolute temperature. On the assumption that the translational kinetic energy of the ions has the same mean value as the molecules of a gas at the same temperature, the charge of the thermo-ions is found to $1·55 \times 10^{-20}$ electrostatic units. This is approximately the same as the charge carried by ions from other sources. H. M. D.

Extension of the Law of Corresponding States. HANS HAPPEL (*Physikal. Zeitsch.*, 1909, 10, 687—693).—From the relationship which according to the theory of Clausius and Mosotti exists between the dielectric constant, the volume of the molecules, and the specific volume of a substance, the author considers that substances in corresponding states should have the same dielectric constant. By reference to the data for carbon tetrachloride, benzene, and other aromatic hydrocarbons, hexane, octane, carbon dioxide, nitrous oxide, oxygen, nitrogen, and carbon monoxide, it is shown that this is approximately true if the substances compared show a certain degree of correspondence. H. M. D.

Conductivity and Ionisation of Polyionic Salts. ARTHUR A. NOYES and JOHN JOHNSTON (*J. Amer. Chem. Soc.*, 1909, 31, 987—1009).—In an earlier paper (Abstr., 1908, ii, 347) an account was given of a study of the ionisation and conductivity of various salts in aqueous solution through a wide range of temperature. As these salts contained only univalent and bivalent ions, the investigation has now been extended to salts containing ions of higher valency as well as to other salts of the uni-bivalent type.

Measurements have been made of the conductivity of aqueous solutions of various concentrations and at temperatures ranging from 0° to 156°, of one uni-univalent salt, potassium nitrate; two uni-bivalent salts, potassium oxalate and calcium nitrate; two uni-tervalent salts, potassium citrate and lanthanum nitrate; and four salts of still higher types, namely, potassium, calcium, and barium ferrocyanides, and lanthanum sulphate. The results show that the principles previously derived (*loc. cit.*) from a study of the salts of uni-univalent and uni-bivalent types apply also to those of higher types.

The depression of the f. p. caused by most of the salts studied has also been determined. From these measurements, the mol. number, i (the number of mols. resulting from one formula weight of the salt), has been calculated, and compared with the mol. number derived from the conductivity by the expression: $i = 1 + (n-1)(\Lambda/\Lambda_0)$. Between the two values thus obtained for i, considerable differences exist which cannot be explained. E. G.

Change of the Equivalent Conductivity of Ions with the Temperature. JOHN JOHNSTON (*J. Amer. Chem. Soc.*, 1909, 31, 1010—1020).—In a study of the conductivity of polyionic salts (preceding abstract), the values were required of the equivalent conductivity, Λ_0, at zero concentration between 0° and 156°. Since actual measurements with extremely dilute solutions are not trustworthy, the values have been calculated on the assumption that at the higher temperatures the equivalent conductivities of the potassium and chloride ions are equal.

The results show that the equivalent conductivity of each of the ions of the salts studied (*loc. cit.*), except the hydrogen and hydroxyl ions, is a function of the fluidity, ϕ, of water, of the form $\Lambda = k\phi^m$, where m is a constant for each ion varying between 0·81 and 1·03 for the different ions. It is also shown that the relation between Λ and the temperature t can be expressed by the equation: $\Lambda = (1/k)(t + 43{\cdot}25)^p$. Values of the constants p and of log k are given, so that the conductivity of any ion at any temperature can be calculated.

Values of the ratio Λ/ϕ are also given for the various ions at the different temperatures, and these indicate that the ratio decreases as the temperature increases, the decrease being greater the greater the conductivity, and also that the exceptional behaviour of some of the ions, especially those of higher valency, is due to a change in their state of hydration with the temperature.

It is shown, by means of the data published by Dutoit and Duperthuis (this vol., ii, 120), that analogous results obtain with solutions of sodium iodide in various organic solvents. E. G.

Electrical Conductivity and Plasticity of Isomorphous Mixtures of Lead with Indium and Thallium. Nicolai S. Kurnakoff and S. F. Schemtschuschny (*Zeitsch. anorg. Chem.*, 1909, 64, 149—183).—Lead and indium form a complete series of isomorphous mixtures. The electrical conductivity measured on drawn wires has been determined at 25° and 100°. The conductivity curve and the curve of temperature-coefficients of the resistance have the U-shape characteristic of isomorphous series. The plasticity is measured by determining the pressure required to produce flow through a given opening at the ordinary temperature. Using a cylinder 8·66 mm. in diameter and an aperture 2·81 mm., a pressure is required which varies from 10·6 kilograms per sq. mm. for pure lead and 3 06 for pure indium to 23·72 for a mixture of equal atomic proportions of the two metals. The curve is the reverse of the conductivity curve.

Lead and thallium (Kurnakoff and Pushin, Abstr., 1907, ii, 262) form two series of solid solutions, α from 0 to 6·5 and β from 24·7 to 100 atomic % Pb. There is a maximum on the freezing-point curve at about 36 atomic % Pb, but this does not correspond with any compound, although Lewkouja (Abstr., 1907, ii, 261) assumes the existence of $PbTl_2$. The conductivity and temperature-coefficient curves are quite continuous throughout the β-range, indicating a continuous series of solid solutions without any compound. The conductivity of thallium is lowered by the addition of lead, reaching a minimum at 3 atomic % Pb, and then rising to a maximum near the original value. The existence of a third solid solution, γ, is thus indicated lying between the α and β ranges. A quite similar curve is given by the pressures required to produce flow.

Measurements of the plasticity of crystalline salts show that the pressure required to produce flow diminishes in the series: alkali chloride, bromide, iodide; and rubidium, potassium, ammonium, but increases in the series silver chloride, bromide, iodide. Salts containing water of crystallisation flow under a low pressure. Among metals, the pressure is found to increase in the order Na, In, Tl, Pb, Sn, Bi, Cd, Zn. The hardness, measured by Brinell's ball test, gives a curve closely parallel with that of the pressure, and either method may be used indifferently to measure hardness. C. H. D.

New Method for Measuring the Electrolytic Dissociation of Water. C. S. Hudson (*J. Amer. Chem. Soc.*, 1909, 31, 1136—1138).—It has been shown (Abstr., 1907, ii, 942) that tho velocity coefficient, k, of the mutarotation of dextrose in aqueous, acid, or alkaline solution is given by the expression: $A + B(H^{\cdot}) + C(OH')$, where A, B, and C are constants, and $H^{\cdot}$ and OH' the concentrations of the hydrogen and hydroxyl ions in the solutions. If the velocity coefficient in aqueous solution is written k_w, and the hydrogen ion concentration, which in this case is equal to that of the hydroxyl ion, is written $H^{\cdot}_w$, we have $k_w = A + (B + C)H^{\cdot}_w$, which gives

$$H^{\cdot}_w = (k_w - A)/(B + C).$$

This relation affords a new method for determining the electrolytic dissociation of water, since k_w, A, B, and C can be found experimentally by determining the rate of mutarotation of dextrose in aqueous,

acid, and alkaline solutions. The method is not very accurate, but it is probable that better results could be obtained from measurements with lævulose.
E. G.

Electromotive Forces Produced by Acid and Alkaline Solutions Streaming through Glass Capillary Tubes.

Alexander T. Cameron and Erich Oettinger (*Phil. Mag.*, 1909, [vi], 18, 586—603).—When aqueous solutions are caused to flow through a capillary tube containing electrodes, potential differences are established, and these have been measured for very dilute solutions of acids and alkali hydroxides. From the results the authors draw the conclusion that the value of 5 volts, given by Helmholtz and Dorn as the potential difference between glass and water, is approximately correct. For dilute solutions of acids and alkalis (1/1000 to 1/5000 normal), the corresponding potential differences are about 0·5 volt smaller or larger. Although the sign of the change in the potential difference is that predicted by Helmholtz's theory, the magnitude is about three times as large as that indicated by theory.
H. M. D.

Electromotive Force of Iodine Concentration Cells, One Electrode of which is Saturated with Iodine.

Arthur P. Laurie (*Zeitsch. physikal. Chem.*, 1909, 67, 627—639. Compare Abstr., 1908, ii, 1007).—The proportion of iodine ions in solutions of potassium iodide of different concentrations, saturated with iodine, has been determined by measurements of the *E.M.F.* of iodine concentration cells. One electrode was surrounded by a solution of potassium iodide containing a little iodine, the other by solutions of potassium iodide of varying concentration, saturated with iodine, and the values of the I'-ion concentration were calculated by substitution in Nernst's equation in the usual way. The contact differences of potential were corrected for by using a concentrated solution of ammonium nitrate. Measurements of the solubility of iodine in solutions of potassium iodide from 0·344*N* to *N* have also been made at 25°.

The results show that in solutions of potassium iodide from 0·025*N* to *N*, saturated with iodine, the number of molecules of the free potassium iodide and bound iodine is approximately equal to that of the total potassium iodide added, hence even in the stronger solutions there is very little formation of polyiodides higher than KI_3. In a solution 3*N* with reference to potassium iodide, there is distinct evidence of polyiodide formation, although the proportion is still comparatively small.

In another series of measurements at 20·4°, the proportion of I'-ions present in solutions containing iodine in varying proportions up to saturation has been determined, and certain conclusions are drawn from the results. In a normal solution of potassium iodide containing very little iodine, the dissociation constant for the equilibrium $I_3 \rightleftharpoons I_2 + I$ is the same as that in dilute solutions, but alters when more iodine is present, the I_3 molecules becoming more stable.
G. S.

Piezochemical Studies. III. Influence of Pressure on the E.M.F. of the Weston Element. Ernst Cohen and L. R. Sinnige (*Zeitsch. physikal. Chem.*, 1909, 67, 513—537. Compare this vol., ii, 291, 641, 796).—It is shown that the influence of pressure on the *E.M.F.* of the Weston and Clark cells is satisfactorily represented by means of the equation : $E_\pi - E_0 = \pi(v_1 - v_2)$ (1), where v_1 and v_2 represent the volumes of a gram-equivalent of the cell-materials before and after the passage of 96,540 coulombs of electricity through the cell, and π is the pressure.

The total change of volume $(v_1 - v_2)$ occurring in the Weston cell as a consequence of the passage of 96,540 coulombs is considered as regards its separate parts, which are calculated from known data, or have been determined specially. In the course of the experiments it has been found that D_4^{25} for cadmium is 8·643, and D_4^{25} for mercurous sulphate, 7·064. The value of $v_1 - v_2$ is $-6·64$ c.c. at 25°. When this value (with the sign reversed) is substituted in equation (1), $dE/d\pi = 6·97 \times 10^{-6}$ volts per atmosphere at 25°. $dE/d\pi$ has also been determined directly between 0 and 1000 atmospheres, as described in the previous paper, and the value $6·32 \times 10^{-6}$ volts per atmosphere at 25° was obtained, in good agreement with the above value.

Similar measurements have also been made with the Clark cell. The value of $dE/d\pi$, obtained directly and according to equation (1), is in both cases $13·0 \times 10^{-6}$ volts per atmosphere. G. S.

Oxide Theory of Oxygen Electrodes. VI. Richard Lorenz [and, in part, Percy E. Spielmann and N. Konstantinoff (*Zeitsch. Elektrochem.*, 1909, 15, 661—666. Compare this vol., ii, 640).—The arrests in the discharge curve of a polarised platinum anode at higher potentials than 0·93 volt probably correspond with unknown higher oxides of platinum. An electrode immersed in solutions containing persulphuric acid showed potentials varying from 0·88 to 1·11 volts; these results cannot be interpreted at present. The curve representing the current as a function of the *E.M.F.* applied to a pair of platinum electrodes shows very indistinct indications of a change in the process occurring at the anode at 0·8 to 1, 1·4, 1·6, and 2·1 volts with sulphuric acid as electrolyte; when a concentrated solution of hydrochloroplatinic acid is used, the points at 1·0 and 1·6 volts become very sharply defined, indicating that platinum ions take part in the change.

In order to obtain an arrest on the discharge curve of a polarised lead anode, it is necessary to polarise with a certain minimum *E.M.F.*, which is from 0·38 to 0·67 volt higher than the corresponding value found on discharging the electrode. Furthermore, the curve connecting current and applied *E.M.F.* during the change exhibits discontinuities, and in order to develop an arrest in the discharge curve it is necessary to pass one of these discontinuities on the charge curve. The author, therefore, assumes that these points on the charge curve are not, as Le Blanc thinks, due to the discharge of an ion in the solution, but rather to the formation of some compound at the electrode. Each such compound requires a definite *E.M.F.* to produce it, and yields a definite lower *E.M.F.* when it is decomposed during the discharge of the electrode. T. E.

The Metal Tungsten as Valve Electrode. L. H. WALTER (*J. Proc. Inst. Elect. Eng.*, 1909, **43**, 547—552).—The tungsten anode was made from the filament of an Osram lamp; one end was embedded in Wood's metal, which served as a support; the cathode was a lead cylinder with about 30 sq. cm. area; the anode had an area of about 0·1 sq. cm. The tungsten anode has a very pronounced valve action, the insulating film being formed even with an alternating current. The maximum voltage which the tungsten anode will resist is higher than that found for aluminium, but lower than for tantalum. In sulphuric acid (D 1·2) at 15° it is about 90 volts, and it is not very much reduced by rise of temperature. The resistance falls off very quickly when the current is interrupted. T. E.

Modification of Ostwald's Bromide Voltameter. WARREN K. LEWIS (*J. Amer. Chem. Soc.*, 1909, **31**, 1145—1146).—In the course of certain work, a voltameter was required for use with exceedingly small currents, the total precipitate being only a few milligrams. It was necessary that the instrument should be free from polarisation and *E.M.F.* due to concentration cell effects or other electrochemical action. The Ostwald bromide voltameter (Oswald-Luther, *Phys.-Chem. Messungen*, 430) appeared well adapted for the purpose, but the platinum point used as a cathode introduces polarisation and the possibility of a cell effect. This objection was overcome by means of the following modification.

The cathode was separated from the anode by a porous cell, and was surrounded by potassium bromide solution of the same strength as that around the anode. Precipitated silver bromide was added to the cathode compartment in sufficient quantity to cover the electrode. Since the potassium bromide solution in both compartments was saturated with silver bromide, the silver ion concentration about both electrodes was the same, and any possible cell effect was thus eliminated. Polarisation was avoided, since the current densities employed were exceedingly small and the solid bromide about the cathode therefore maintained the silver concentration of the solution. The electrodes employed were silver plates with silver or platinum leads. From four to eight separate anodes could be connected simultaneously with a common cathode in the porous cup. This voltameter gave excellent results with current densities precipitating not more than 1·5—2·0 mg. of bromine per hour. E. G.

Apparatus for the Determination of Transport Numbers. ALEXANDER FINDLAY (*Chem. News*, 1909, **100**, 185).—The apparatus consists of three tubes, all of which are furnished with small glass taps, through which the solution can be run out. The two outer tubes contain the electrodes, and are connected to a U-tube by means of rubber tubing furnished with spring clips. During an experiment, the clips are kept open, but at the end thereof they are closed, and the anode liquid run off for analysis through the tap at the bottom of the appropriate tube into a weighed flask. This tube and the electrode are washed with a small quantity of the original solution, the washings being also run into the same weighed flask. The solution in the connecting U-tube can then be run off for analysis.

For the determination of transport numbers in cases where a gas is evolved at the cathode, the cathode outer tube is replaced by a special tube containing a mercury electrode, similar to that used by Hopfgartner (Abstr., 1892, ii, 151).

The apparatus is simple to use, and can be employed in the case of all solutions. T. S. P.

Electrolytic Production of Silver Mirrors. Rudolf Lohnstein (*Physikal. Zeitsch.*, 1909, **10**, 672—673).—When a current of electricity is passed through distilled water between silver electrodes, the formation of a silver mirror on the walls of the glass vessel in the neighbourhood of the cathode can frequently be observed. The mirror formation is appreciably facilitated if reducing substances, such as sugars, glycerol, gelatin, or sodium potassium tartrate, are added to the distilled water. In the case of the last substance, the amount added must be very small, for it is essential that the solution should have a small conductivity. Addition of very small quantities of alkali hydroxide or ammonia to the sugar solutions is also favourable to the production of a mirror.

The phenomenon is supposed to be due to the formation of silver hydroxide at the anode; this is then reduced to metallic silver, which is colloidally dissolved, but separates out under the influence of the current. H. M. D.

Magnetic Properties of Alloys of Manganese, Aluminium and Copper. Alexander D. Ross and Robert C. Gray (*Zeitsch. anorg. Chem.*, 1909, **63**, 349—352. Compare Heusler and Richarz, this vol., ii, 240).—A Heusler's alloy, quenched from 400°, gave a very low hysteresis without reduction of the permeability. The compound Cu_3Al plays an important part in determining the magnetic properties of these alloys. C. H. D.

Magnetic Function of Oxygen in Organic Compounds. Paul Pascal (*Compt. rend.*, 1909, **149**, 508—510. Compare this vol., ii, 487, 788).—The molecular magnetic susceptibility of a simple organic compound is equal to the sum of the susceptibilities of its atoms plus a certain constant when an ethylenic linking or benzene nucleus is present. Oxygen loses its distinctive magnetic character in combination, and may be diamagnetic or paramagnetic according to the distribution of its valencies. The average results obtained by the study of a large number of alcohols, acids, salts, aldehydes, ketones, etc., are as follows: oxygen combined with two other atoms is diamagnetic with susceptibility -50.10^{-7}; combined (bivalent) to one carbon atom which is not in combination with any other oxygen it is paramagnetic ($+20.10^{-7}$); if a second oxygen atom is connected univalently to the carbon atom, the doubly linked oxygen is diamagnetic (-35.10^{-7}).

In addition to the atomic effects, the structure of an oxygenated molecule may influence its magnetic properties. Every tertiary carbon atom has an extra susceptibility of -10.10^{-7}, whilst for a quaternary atom -15.10^{-7} must be added. Nitrogen has a susceptibility of -58.10^{-7}, except when combined with tertiary carbon, when it must be taken as -50.10^{-7}. By means of the rules given, the susceptibility of a substance of known constitution can be calculated with an error of less than 1%, and, conversely, the constitution of a new substance might be decided by its magnetic susceptibility with a precision approaching that of the refractive index method. In the case of several isodynamic compounds, the susceptibility falls between that calculated for the enol and ketonic forms. Ethyl acetoacetate is almost entirely enolic when fresh, but soon changes in contact with a trace of pyridine into the ketonic form. R. J. C.

Thermal Properties of Silver Nitrate. Joseph Guinchant (*Compt. rend.*, 1909, **149**, 569—571. Compare this vol., ii, 790).—From the latent heat of fusion (17·6 cal.) and the melting point (209°) of silver nitrate, its cryoscopic constant, calculated in the manner previously given, should be 264. The values obtained by exterpolation of the cryoscopic constant with infinitely dilute solutions of the following substances are: lithium nitrate 262, potassium nitrate 260, thallium nitrate 260, lead nitrate 283, silver chloride 273, silver iodide 305, silver fluoride 249, silver iodate 290, silver sulphate 289. The experimental molecular lowering, which varies little with the concentration of the solute, is, therefore, normal. Silver nitrate is a practicable solvent for cryoscopic work provided that moisture is carefully excluded.

The eutectic point of thallium nitrate–silver nitrate mixtures (72°) occurs at approximately equimolecular proportions, but microscopic examination shows that the crystals of the two nitrates exist side by side.

On cooling silver nitrate from its melting point, a sudden expansion at about 160° invariably breaks the test-tube. The transformation of monoclinic into orthorhombic silver nitrate at 159° is accompanied by dilatation. This has been measured directly on rods of silver nitrate, and is about 0·22%, a value considerably below that calculated from Retger's results (Abstr., 1889, 931), namely, 1·15%. The contraction of a crystal of silver nitrate at 159° varies, moreover, with the orientation, being greatest (0·6%) in a direction perpendicular to the plane of the optic axes. R. J. C.

Relations between the Cryoscopic Constants and Position Isomerism in Disubstituted Derivatives of Benzene: Influence of the Substituent Groups. Temistocle Jona (*Gazzetta*, 1909, **39**, ii, 289—311).—The author has determined the molecular depressions (K) of the freezing points (F) of a number of ortho-, meta-, and para-disubstituted derivatives of benzene, using as solutes naphthalene, methyl salicylate, phenetole, toluene, and benzil. The results, together with the latent heats of fusion (W) calculated from van't Hoff's formula, $K = 0{\cdot}02.T^2/W$, in cals. per one gram are given in the following table; the values of the m. p. are also given, these differing in some cases from the numbers previously given by different observers.

	Ortho-.			Meta-.			Para-.		
	F.	*K.*	*W.*	*F.*	*K.*	*W.*	*F.*	*K.*	*W.*
Nitrotoluene	–4·14°	71·8	20·14	16·0°	68·4	24·36	54·0°	78·0	27·41
Bromonitrobenzene.	36·5	91·8	20·86	54·0	87·5	24·44	124·0	115·3	27·33
Chloronitrobenzene.	32·5	75·0	24·88	44·4	60·7	33·19	83·0	109·0	23·25
Chlorophenol.........	7·0	77·2	20·55	28·5	83·0	21·78	37·0	85·8	22·40
Dihydroxybenzene .	104·0	71·3	39·86	118·0	65·0	47·04	169·0	—	—

Quinol is unsuitable for use as a cryoscopic solvent, as its m. p. is altered by fusion and re-solidification, even in an atmosphere of hydrogen.

It will be seen that the cryoscopic constants of the para-derivatives are, in all cases, greater than those of the corresponding ortho- and meta-derivatives. Further, except with the chlorophenols, the constants for the meta-derivatives are less than those of the corresponding ortho-derivatives, in spite of the fact that the squares of the absolute m. p.'s are much greater for the meta-compounds than for the ortho-derivatives. As the molecular weights of the solvents increase, in either the ortho- or the meta- or the para-series, the cryoscopic constant exhibits a tendency to increase; the lowerings of the values of the constant for the three nitrotoluenes, even although the molecular weight increases, are probably related to the presence of a methyl group in the nucleus. The results are not in agreement with Raoult's "general law of freezing," which states that if 1 mol. of any substance is dissolved in 100 mols. of any solvent, it effects a depression of the freezing point which is approximately constant and equal to about 0·62°. T. H. P.

Internal Heat of Vaporisation. James E. Mills (*J. Amer. Chem. Soc.*, 1909, **31**, 1099—1130).—The author has calculated the internal heat of vaporisation of thirty-eight substances by means of the equations of (1) Clausius, (2) Mills (Abstr., 1907, ii, 226), and (3) Crompton (Proc., 1901, **17**, 61). The results afford conclusive evidence that these equations are in substantial agreement, and that the divergences in the values obtained are due to experimental error. The interpretation of each equation is fully discussed. E. G.

Partial Vapour Pressures of Binary Mixtures. Martin A. Rosanoff and C. W. Easley (*J. Amer. Chem. Soc.*, 1909, **31**, 953—987).—A new method of measuring the partial vapour pressures of binary mixtures has been described by Rosanoff, Lamb, and Breithut (this vol., ii, 379) which depends on the fact that if a mixed vapour of constant composition is passed through a liquid mixture of the same substances, the composition and temperature of the liquid will steadily change until complete equilibrium, as regards both temperature and pressure, has been established.

The present paper contains an account of the determination of the composition of the vapours in equilibrium with several typical binary mixtures, namely, carbon tetrachloride and benzene, carbon disulphide and acetone, chloroform and acetone, ethylene chloride and benzene, carbon disulphide and tetrachloride, and acetic acid and benzene. Most of these mixtures have been investigated isothermally by

Zawidzki (Abstr., 1901, ii, 6). The new measurements, however, have been carried out, not at constant temperature, as were Zawidzki's, but under the constant pressure of 760 mm. The apparatus employed is described with the aid of a diagram. The results are tabulated and plotted as curves, and are shown to agree fairly closely with those of Zawidzki (*loc. cit.*).

A discussion is given of certain theoretical considerations suggested by the results of this work. E. G.

Molecular Attraction. VIII. James E. Mills (*J. Physical Chem.*, 1909, **13**, 512—531. Compare Abstr., 1906, ii, 216; 1907, ii, 226).—The equation $(L - E)/(\sqrt[3]{d} - \sqrt[3]{D}) =$ const., where L denotes the heat of vaporisation, E the energy spent in overcoming external pressure, and d and D are the densities of liquid and saturated vapour respectively, has now been further tested by means of very accurate data communicated to the author by Young, but not yet published. The values of the constant for each thirty-eight substances through a wide range of temperature are tabulated, and it is shown that, except at 0° and in the neighbourhood of the critical temperature, there is not a single deviation from the mean value of the respective constants greater than 2% for twenty-five of the substances examined. Certain associated liquids, such as water, the alcohols, and acetic acid, show larger deviations. Certain of the deviations for non-associated substances are probably due to errors in determining the physical constants.

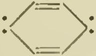
The author points out that these results prove the correctness of the above equation quite independently of the validity of the assumptions on the basis of which it has been derived theoretically. It is shown to lead to the result that in any normal substance the heat given out as the molecules approach each other, multiplied by the distance apart of the molecules, is a constant. G. S.

Thermochemistry of the Halogens. John C. Thomlinson (*Chem. News*, 1909, **100**, 185—186. Compare Abstr., 1908, ii, 1016). —Using the method previously described and assigning definite structural formulæ to the various compounds, the author calculates the heats of formation of chlorine monoxide, chloric acid in water, iodine pentoxide, and bromine pentoxide to be respectively −13·311, 47·880, 57·960, and 37·962 calories. The actual heats of formation in the first three cases are: −17·930, 48·000, and 60·244 calories respectively. T. S. P.

Heat of the Reaction of Formation of Quinone Dichloroimides. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 839—849).—From the values of the molecular heats of combustion, benzene, 779·2 Cal.; benzoquinone, 656·3 Cal.; naphthalene, 1233·6 Cal., and α-naphthaquinone, 1103·7 Cal., it would appear that the heat of formation of the linking 2 (C=O) and of the re-grouping of the naphthalene nucleus into the quinonoid configuration is greater by 7·00 (129·9 − 122·9) Cal. than the heat involved in the formation of the same linking 2 (C=O) and the rearrangement of the benzene nucleus into the paraquinone. The figures given above are, however, not sufficiently exact to render this difference of 7 Cal. accurate to less than 3·0—4·0 Cal.

In view of this large possible error, the author has determined directly tho heats of formation of benzoquinonedichloroimide and α-naphthaquinonedichloroimide from the hydrochlorides of the corresponding diamino-compounds. He finds that the presence of free hydrochloric acid is not necessary for the occurrence of this reaction, which is effected either by chlorine water or by calcium hypochlorite. The results of his measurements are expressed as follows:

$C_6H_4(NH_2)_2,2HCl$ (diss.) + $3Ca(OCl)_2$ (diss.) = $C_6H_4N_2Cl_2$ (solid) + $3CaCl_2$ (diss.) + 90·00 Cal.; $C_{10}H_6(NH_2)_2,2HCl$ (diss.) + $3Ca(OCl)_2$ (diss.) = $C_{10}H_6N_2Cl_2$ (diss.) + $3CaCl_2$ (diss.) + 96·86 Cal.; $C_6H_4(NH_2)_2,2HCl$ (diss.) + $3Cl_2$ (diss.) = $C_6H_4N_2Cl_2$ (diss.) + 6HCl (diss.) + 68·08 Cal.; $C_{10}H_6(NH_2)_2,2HCl$ (diss.) + $3Cl_2$ (diss.) = $C_{10}H_6N_2Cl$ (diss.) + 6HCl (diss.) + 74·82 Cal.; $C_6H_4(NH_2)_2,2HCl$ (solid) + $3Ca(OCl)_2$ (diss.) = $C_6H_4N_2Cl_2$ (solid) + $3CaCl_2$ (diss.) + 83·31 Cal.; $C_{10}H_6(NH_2)_2,2HCl$ (solid) + $3Ca(OCl)_2$ (diss.) = $C_{10}H_6N_2Cl_2$ (solid) + $3CaCl_2$ (diss.) + 89·13 Cal.; $C_6H_4(NH_2)_2,2HCl$ (solid) + $3Cl_2$ (diss.) = $C_6H_4N_2Cl_2$ (solid) + 6HCl (diss.) + 61·39 Cal.; $C_{10}H_6(NH_2)_2,2HCl$ (solid) + $3Cl_2$ (diss.) = $C_{10}H_6N_2Cl_2$ (solid) + 6HCl (diss.) + 67·09 Cal.

The heat of formation of solid α-naphthaquinonedichloroimide from the solid diamino-hydrochloride is hence found to be 5·82 Cal. (89·13—83·31) or 5·7 Cal. (67·09—61·39) greater than the heat of formation of solid benzoquinone dichloroimide. The heat of formation of the grouping ClN::NCl in the naphthalene nucleus is hence 5·76 Cal. greater than its heat of formation in the benzene nucleus; the experimental error in this value is not more than 0·7—0·9 Cal.

T. H. P.

Thermochemical Investigations on Nitro-compounds. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 920—925).—The author has measured the molecular heats of combustion of the following compounds.

Nitromethane, 169·95 Cal. (v const.), 169·5 Cal. (p const.), 178·7 Cal. (gas, p const.). α-Nitropropane, 477·8 Cal. (v const.), 478·0 Cal. (p const.), 489·4 Cal. (gas, p const.) (compare Thomsen, *Thermochem. Untersuch.*, 1886, 4, 215; Berthelot and Matignon, Abstr., 1894, i, 158).

Denoting the heats of formation of the various atomic linkings as follows: $C-H$, x; $C-C$, y; $C-N$, β; $N-O$, μ; $O-O$, ω; $H-O$, u; $C-O$, z; and $N-N$, n, the author calculates the values of $[\beta-z+(\omega-n)/2+4\mu-n-2\omega]$ for various nitro-derivatives to be: nitromethane, −20·0 Cal.; nitroethane, −15·3 Cal.; α-nitropropane- −14·2 Cal.; nitrobenzene, −14·0 Cal.; *o*-dinitrobenzene, −17·4 Cal.; *m*-dinitrobenzene, −14·1 Cal.; and *p*-dinitrobenzene, −13·1 Cal. (compare this vol., ii, 547).

The thermochemical value of the $C-N'''$ linking in amines seems to be identical with that of the $C-N^{v}$ linking in nitro-compounds.

T. H. P.

Calorimetric Investigation of the Formation of Azo-compounds. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 925—932).—The calorimetric measurements here described, dealing with the heats of formation of *p*-aminoazobenzene and naphthaleneazo-*a*-naphthylamine, were made with the object of arriving at values for the heat of formation of the linking (N:N) in azo-compounds. The results are expressed shortly as follows: $2C_{10}H_7{\cdot}NH_2$ (solid) + $NaNO_2$ (solid) + $nCH_3{\cdot}CO_2H$ (liq.) = $C_{10}H_7{\cdot}N_2{\cdot}C_{10}H_6{\cdot}NH_2$ (solid) + $CH_3{\cdot}CO_2Na$ (diss.) + $2H_2O$ (diss.) + $(n-1)CH_3{\cdot}CO_2H$ (liq.) + 47·44 Cal.; $2Ph{\cdot}NH_2$ (liq.) + $NaNO_2$ (solid) + $nCH_3{\cdot}CO_2H$ (liq.) = $Ph{\cdot}N_2{\cdot}C_6H_4{\cdot}NH_2$ (solid) + $CH_3{\cdot}CO_2Na$ (diss.) + $2H_2O$ (diss.) + $(n-1)CH_3{\cdot}CO_2H$ (liq.) + 43·20 Cal.

The heat of formation of the linking (N:N) in naphthaleneazo-*a*-naphthylamine is hence 4·24 Cal. greater than its heat of formation in *p*-aminoazobenzene. This result is similar to those found for the heats of formation of other atomic linkings in the naphthalene and benzene nuclei (compare this vol., ii, 862).

Further considerations lead to the conclusion that the heat of formation of the linking (N:N) is greater by 45·5 Cal. than the heat of formation of two linkings of nitrogen in the molecule of that element.

T. H. P.

Thermochemistry of Nitroso-compounds. W. Sventoslavsky (*J. Russ. Phys. Chem. Soc.* 1909, 41, 933—950. Compare this vol., ii, 547, and preceding abstracts).—From the results of measurements of the heats of formation of phenylethylnitrosoamine and diphenylnitrosoamine, namely, NHPhEt (diss.) + $NaNO_2$(solid) + $C_2H_4O_2$(liq.) = NPhEt·NO (diss.) + $C_2H_3O_2Na$ (diss.) + H_2O (diss.) + 11·66 Cal. and $NHPh_2$ (diss.) + $NaNO_2$ (solid) + $C_2H_4O_2$ (liq.) = $NPh_2{\cdot}NO$ (diss.) + $C_2H_3O_2Na$ (diss.) + H_2O (diss.) + 13·45 Cal. (compare this vol., ii, 794), it was concluded that the formation of the linking (N–N) in phenylethylnitrosoamine is less by 1·79 Cal. than the heat of formation of the same linking in diphenylnitrosoamine. This conclusion was based on the assumption that the difference between the heats of solution of phenylethylamine and its nitroso-derivative in acetic acid differed little from the difference between the heats of solution of diphenylamine and diphenylnitrosoamine in acetic acid, which assumption is now shown by the results described in the present paper to be erroneous.

The molecular heat of combustion of dimethylnitrosoamine has the value 394·3 Cal. (*v* or *p* const.) or 407·86 Cal. (gas). Denoting the heat of formation of the linking (N–N) by n, and that of (N:N) by $3n$, the value of $(n-n_1)$ is calculated to be 19·0 Cals.

The heat of formation of phenylethylnitrosoamine is found to be: NHPhEt (liq.) + $NaNO_2$ (solid) + $C_2H_4O_2$ (liq.) = NPhEt·NO (liq.) + $C_2H_3O_2Na$ (diss.) + H_2O (diss.) + 18·61 Cal., which gives the value 14·0 Cal. for $(n-n_1)$. In presence of excess of nitrous acid, this heat of formation is expressed by the equation: NHPhEt (liq.) + HNO_2 (diss.) = NPhEt·NO (liq.) + H_2O (diss.) + 18·97 Cal. The agreement between these two results shows that the formation of the nitroso-compound is quantitative as well when excess of nitrite as when excess of amine is present, and that the sum of the heats of the accessory processes, namely, the solution of water in acetic acid and the solution of sodium nitrite in acetic acid with formation of sodium acetate and nitrous acid, is zero.

The heats of formation of diphenylnitrosoamine and ββ-dinaphthylnitrosoamine are as follows: $NHPh_2$ (diss.) + $NaNO_2$ (solid) + $C_2H_4O_2$ (liq.) = $NPh_2\cdot NO$ (diss.) + $C_2H_3O_2Na$ (diss.) + H_2O (diss.) + 13·45 Cal., or with $NHPh_2$ (solid) and $NPh_2\cdot NO$ (solid), + 14·92 Cal.; and $C_{20}H_{15}N$ (diss.) + $NaNO_2$ (solid) + $C_2H_4O_2$ (liq.) = $C_2H_3O_2Na$ (diss.) + H_2O (diss.) + $C_{20}H_{14}ON_2$ (diss.) + 14·62 Cal. So that, in this case, replacement of the phenyls by naphthyls results in an increase of the heat of formation by 1·17 Cal. (14·62—13·45). The heat of reaction of 1 mol. $NaNO_2$ on excess of diphenyl-*m*-phenylenediamine is 16·74 Cal., whilst the formation of diphenyl-*m*-phenylenedinitrosoamine is represented by: $C_6H_4(NHPh)_2$ (diss.) + $NaNO_2$ (diss.) + $2C_2H_4O_2$ (liq.) = $C_6H_4(NO\cdot NPh)_2$ (diss.) + $2H_2O$ (diss.) + $2C_2H_3O_2Na$ (diss.) + 2 × 19·56 Cal.

These results, which are discussed in relation with those previously obtained, indicate the identity of the heats of formation of the linkings $(N\cdot N^{III})$ and $(N\cdot N^{V})$, which shows that these heats of formation are subject to the influences of the atoms and radicles which surround them, and are independent of the chemical characters of the whole compounds. T. H. P.

Heat of Combination of Acidic Oxides with Sodium Oxide. IV. Heat of Formation of Trisodium Orthophosphate, Trisodium Orthoarsenate, the Oxides of Antimony and Bismuth Trioxide. WILLIAM G. MIXTER (*Amer. J. Sci.*, 1909, [iv], **28**, 103—111. Compare this vol., ii, 644).—The heats of formation have been calculated from the thermal data obtained in the oxidation of the elements or lower oxides by means of sodium peroxide. The trustworthiness of the method is shown in the agreement of some of the constants with the values obtained by other methods: $3Na_2O + P_2O_5 = 2Na_3PO_4 + 233\cdot392$ Cal.; $3Na_2O + As_2O_5 = 2Na_3AsO_4 + 202\cdot8$ Cal.; $3Na_2O + 2Sb + 5O = 2Na_3SbO_4 + 393\cdot3$ Cal.; $2Sb + 3O = Sb_2O_3 + 163\cdot0$ Cal.; $2Sb + 4O = Sb_2O_4 + 209\cdot8$ Cal.; $2Sb + 5O = Sb_2O_5 + 229\cdot6$ Cal. H. M. D.

Thermochemistry of Phosphorus Compounds. PAUL LEMOULT (*Compt. rend.*, 1909, **149**, 554—556. Compare this vol., ii, 936).—The heats of combustion of triphenylphosphine, triethylphosphine, *o*-phosphoranilide, and *o*-phosphor-*o*-toluidide have been determined by the bomb calorimeter. Combustion is not complete in absence of potassium nitrate (*loc. cit.*), but the decomposition of the latter introduces an uncertainty in the thermal values, and it has not been employed. The error from unburnt phosphorus is of the order 0·5%. Also, in the case of triethylphosphine, a small proportion distilled into the water at the bottom of the bomb and escaped combustion. The following values were obtained for the combustion of 1 gram of substance at constant pressure: triphenylphosphine, 2480·7 cal.; triethylphosphine, 1249·7 cal.; phosphoranilide, 2458·3 cal.; phosphor-*o*-

toluidide, 2927·7 cal. The corresponding heats of formation are 382·2, 142·1, 168·6, and 189·1 cal. respectively. The heats of formation of the three phosphoric acids being very similar and the ortho-acid constituting 85% of the product, it is assumed in calculating the heats of formation given above that this acid alone is produced. The author calculates that the contribution of the phosphorus atom to the heat of combustion of phosphine is 228·7 Cal., of triphenylphosphine 232·2 Cal., and of triethylphosphine 229·7 Cal., whereas the heat of combustion of white phosphorus is 308·5 Cal. Hence the heat of transformation of combined phosphorus into white phosphorus is − 78 Cal. per atom, or − 312 Cal. per molecule of P_4.

The substitution of phenyl for hydrogen in phosphine increases the heat of combustion by 723·2 Cal. per phenyl group, a value in close agreement with the normal increment of 722 Cal. in compounds not containing phosphorus. R. J. C.

Heat Effect and Free Energy of Chemical Action in Different Solvents. LEO PISSARJEWSKY and A. SCHELJAPIN (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 795—813).—In order to study the heat effect of the reaction $2AgCN + KBr \rightleftharpoons KAg(CN)_2 + AgBr$ (which proceeds slowly) in different solvents, the authors have measured the separate heat effects of the two reactions: $AgCN + KCN = KAg(CN)_2$ and $AgBr + 2KCN = KAg(CN)_2 + KBr$. The solvents employed were water and aqueous solutions, of various concentrations, of glycerol and methyl alcohol. Similarly, the heat effect of the reaction $2AgCN + KCNS \rightleftharpoons KAg(CN)_2 + AgCNS$ in water and in aqueous glycerol was arrived at from the measurements for the reactions $AgNO_3 + KCN = AgCN + KNO_3$, $AgNO_3 + 2KCN = KAg(CN)_2 + KNO_3$, and $AgNO_3 + KCNS = AgCNS + KNO_3$.

In the case of the former reaction, if the reacting substances are mixed in such concentrations that, immediately after mixing, the concentration of each is unity, the reaction will proceed in the direction of formation of $KAg(CN)_2$ and AgBr, and the measure of the affinity constraining the reaction in that direction will be the maximal work or diminution of free energy, which amounts to 1·118 Cal. in 9·8% aqueous glycerol, and 1·337 Cal. in 99·4% aqueous glycerol. The values of the heat effect, namely, − 0·055 Cal. in the first solution and − 2·667 Cal. in the second, indicate that the reaction should proceed in the opposite direction; such a result was, however, found only in these two instances, and in the majority of cases the heat effect may serve as an approximate measure of the maximal work, and consequently of the affinity. Between the diminution of free energy and the internal friction in the different solvents there exists no such simple relation as was observed by Pissarjewsky and Lovites (Abstr., 1908, ii, 570) for the reaction $Ca(OH)_2 + K_2SO_4 \rightleftharpoons CaSO_4 + 2KOH$. The results obtained also indicate that, when the solution contains excess of potassium cyanide, there are present, in addition to the ions $Ag(CN)_2'$, also ions $Ag(CN)_3''$, and possibly some still more complex (compare Bodländer and Eberlein, Abstr., 1904, ii, 401).

The curve expressing the change of the heat effect of the reaction $2AgCN + KCNS \rightleftharpoons KAg(CN)_2 + AgCNS$ on addition of glycerol to the aqueous solvent is, in general, similar to the curves for the reaction between 2AgCN and KBr in aqueous glycerol and aqueous methyl alcohol. T. H. P.

Easy Method for Determining Vapour Densities. PHILIP BLACKMAN (*J. Physical Chem.*, 1909, **13**, 532—537).—Into a graduated capillary tube (open at both ends, with a tap at one end), which may be bent several times, is sucked a little mercury, then a short thread of the liquid, the vapour density of which is to be determined, and, finally, a little more mercury; the tap is then closed. The length of the thread of liquid between the two threads of mercury is measured, the tube is enclosed in a jacket, heated at constant temperature above the point of vaporisation of the liquid, and the length of the vapour column measured. Some modifications of the method are also described. A formula for calculation and a table of results are given. G. S.

Viscosity of Certain Gases and Gas Mixtures at Different Temperatures. KARL SCHMITT (*Ann. Physik*, 1909, [iv], **30**, 393—410).—Measurements are recorded of the viscosity of helium, argon, hydrogen, oxygen, nitrogen, and air at temperatures ranging from $-190°$ to $+183°$. Mixtures of helium and argon, hydrogen and oxygen, hydrogen and nitrogen, and oxygen and nitrogen have also been investigated at different temperatures. The addition of helium to argon increases the viscosity, although the coefficient of viscosity of helium is less than that of argon. A maximum viscosity is reached when the mixed gas contains 40% of helium. Small quantities of oxygen and nitrogen increase the viscosity of hydrogen to a marked extent; on the other hand, the viscosities of oxygen and nitrogen are only slightly altered by the addition of small quantities of hydrogen. The viscosities of the various gas mixtures can in general be represented by means of Sutherland's formula. H. M. D.

Viscosity of Liquids as a Temperature Function. MARCEL BRILLOUIN (*Ann. Chim. Phys.*, 1909, [viii], **18**, 197—213. Compare Thorpe and Rodger, *Phil. Trans.*, 1894, *A*, **185**, 397—710; 1897, *A*, **189**, 71).—The hyperbolic formula of Graetz, $\eta = A(t - t_0)/(t - t_1)$, represents with satisfactory approximation the viscosities measured by Thorpe and Rodger in the case of those liquids the other properties of which (surface tension, density, etc.) are normal. If, however, the results are corrected by reference to a smooth curve plotted about the experimental points, the corrected values do not give such good agreement with the formula as the experimental ones. The author discusses at length the sources of error in drawing a smooth curve by the ordinary flexible laths, etc., and concludes that the "smoothed" results employed by Thorpe and Rodger cannot be so trustworthy as their experimental results. Moreover, the formula adopted by Thorpe and Rodger, namely Slotte's, has no simple theoretical meaning In Graetz's formula, t_0 is a temperature somewhat above the critical temperature, where the viscosity (η) would be zero, t_1 is a temperature somewhat below the solidifying point, where the viscosity would be infinitely great, A is the viscosity at a mean temperature $(t_0+t_1)/2$.

Graetz's formula is in good agreement with the measured viscosities of sixteen hydrocarbons, four halogenated hydrocarbons, and carbon disulphide. In the case of substances like methyl alcohol and water, the surface tension of which is abnormal at low temperatures, the actual viscosity increases more rapidly than the calculated viscosity as the temperature falls. Methyl alcohol above 20° and water above 35° are almost normal, but below these temperatures there is a growing disagreement with the formula. With substances of higher molecular weight and more complicated structure, such as dimethylethylcarbinol, neither Slotte's nor Graetz's formula explains the course of the viscosity curve. The author obtains the best agreement by introducing two new constants, c and c_1 (making five constants in all), and writing the formula thus: $\eta=A\sqrt{T}\{(t-t_1)^2+c\}/\{(t+t_0)^2+c_1\}$, where T is the absolute temperature. This formula requires a minimum viscosity at a certain temperature, the significance of which, should it be found to exist, is discussed from the point of view of the spheres of repulsive action of the liquid molecules. R. J. C.

Adsorption of Colouring Matters. Herbert Freundlich and Walter Neumann (*Zeitsch. physikal. Chem.*, 1909, 67, 538—550. Compare Freundlich and Losev, Abstr., 1907, ii, 534).—Further experiments on the scission of dyes, more particularly new magenta, by adsorbing substances, such as charcoal, soot, and arsenic sulphide, are described. When new magenta is shaken with charcoal (from blood) or soot, a considerable proportion of the chlorine (20—30% under the experimental conditions employed) remains in solution in the form of chlorine ions, and the dye is almost completely adsorbed by the charcoal. The solution, however, is neutral to litmus, and it has not been found possible to establish with certainty the nature of the cation or cations. Small proportions of $H^{\cdot}$ ions and of $Ca^{\cdot\cdot}$ ions are present, but not nearly equivalent to the Cl' ions in the solution. The main proportion of the cations probably originate from impurities on the surface of the charcoal.

In another series of experiments, solutions of colloidal arsenious sulphide were completely precipitated by new magenta. In this case practically all the chlorine remained in solution in the form of Cl' ions, and an equivalent amount of $H^{\cdot}$ ions was also present. The latter probably originate from arsenious acid or hydrogen sulphide, present as impurity in the colloidal arsenious sulphide solution. Similar results were obtained when morphine hydrochloride was substituted for new magenta.

It is pointed out that, contrary to the opinion expressed in the earlier paper, it is quite in accordance with the law of absorption, that an adsorbing agent which has taken up completely an adsorbable substance from solution does not give up any of the adsorbed substance to pure water. G. S.

Capillary Phenomena. Zdenko H. Skraup (*Monatsh*, 1909, 30, 675—680).—When a drop of dilute aqueous solution of an acid is placed on filter-paper, it spreads out in the form of a circle, the acid being surrounded by a wider ring of water. Holmberg (this vol., ii, 25) has based on this phenomenon a method for estimating the strength of very dilute acid solutions, depending on the relative diameters of the rings. The author has repeated and confirmed Holmberg's work, but finds it more convenient to measure the capillary ascent on long strips of indicator paper dipped into the solutions. It is remarkable that the same values are obtained when the distances thus measured are substituted in Holmberg's quadratic formula (applied by him to spreading out in a circle).

The height to which the solute extends for a total rise of 100 mm. has been measured for a number of electrolytes in different dilutions. There is very little difference in the height to which equivalent solutions of strong acids ascend. In normal solution, strong bases ascend to the same height as acids in corresponding dilution, but in dilute solution bases ascend somewhat higher than acids. In general, weak bases and acids ascend somewhat higher than strong ones in equivalent dilution.

In the case of lead acetate, three zones are to be observed on the paper: the wet zone, below that an acid zone, and finally a basic zone. This phenomenon is due to hydrolysis, and is very suitable as a lecture experiment. Hydrolysis can also be shown in the case of copper sulphate, by treating the moistened paper with hydrogen sulphide, but the acid zone in this case is only a little above the darkened zone.

G. S.

Relations in Capillarity. R. D. Kleeman (*Phil. Mag.*, 1909, [vi], **18**, 491—510).—Several relationships connecting the potential energy of the surface with other physical constants of a liquid have been deduced, and the relationships have been tested by applying to them the data for a considerable number of organic compounds.

H. M. D.

Gaps in Miscibility of Isomorphous Substances. Zinc Silicofluoride and Stannifluoride. Willem Stortenbeker (*Zeitsch. physikal. Chem.*, 1909, **67**, 618—626).—In a previous paper (Abstr., 1903, ii, 470) the author has maintained that limited miscibility in the case of isomorphous substances is rare or non-existent, whilst Gossner (Abstr., 1907, ii, 532) has given various instances of such limited miscibility, for example, the hexahydrates of zinc silicofluoride and zinc stannifluoride. The author has prepared the last two salts, and investigated their miscibility in the usual way. From solutions containing fairly large proportions of both components, small crystals have been obtained under certain conditions which appear to contain both components, and it is suggested that the two salts in question can be made to form a continuous series of mixed crystals, although under other conditions they show a tendency to crystallise separately, as found by Gossner. G. S.

Liquid Mixed Crystals in Binary Systems. Ada Prins (*Zeitsch. physikal. Chem.*, 1909, **67**, 689—723).—The paper deals with the equilibrium relations in binary systems when one or both components can be obtained as a crystalline liquid. In the theoretical part, the possible temperature-composition curves are figured and discussed, the occurrence of metastable liquid crystals (Lehmann) and of complete and partial miscibility in the solid state being taken into account. The temperature at which liquid crystals appear on heating is termed the transition point (*t. p.*), and that at which the liquid crystals give place to an isotropic liquid the melting point.

The systems *p*-azophenetole and *p*-azoxyphenetole, cholesteryl *iso*butyrate, propionate, and benzoate with *p*-azoxyphenetole, and *p*-methoxycinnamic acid and *p*-azoxyanisole with *p*-azoxyphenetole, have been investigated. The transition and melting points of the mixtures, contained in small tubes, were determined in the usual way, and in many cases the changes on gradually raising the temperature were observed microscopically. Special arrangements for making microscopic observations at known temperatures are described.

The m. p. of *p*-azophenetole is 162·4°; the t. p. of *p*-azoxyphenetole is 138·4°, the m. p. 167·3°. The m. p. of *p*-azophenetole is lowered by the addition of *p*-azoxyphenetole, solid mixed crystals (β-crystals) separating on cooling. Similarly, the m. p. of *p*-azoxyphenetole is lowered by adding *p*-azophenetole; in this case liquid mixed crystals (α-crystals) separate. The α- and β-crystals are not isomorphous, but on cooling they change to a continuous series of β-crystals, and on still further cooling probably into another form of mixed crystals. The eutectic mixture contains about 20 mols. % *p*-azophenetole. The recent work of Bogojawlensky and Winogradoff (Abstr., 1908, ii, 809) on this system is adversely criticised.

The freezing-point curve of the system cholesteryl *iso*butyrate–*p*-azoxyphenetole is somewhat similar to that just described. On one side of the eutectic point solid *iso*butyrate, on the other liquid mixed crystals, separate from the fused mass. Pure cholesteryl *iso*butyrate does not form liquid crystals, but on addition of *p*-azoxyphenetole a region of metastable liquid crystals appears; they become stable when more than 30% of *p*-azoxyphenetole is present.

Cholesteryl propionate and *p*-azoxyphenetole give rise to a continuous series of liquid mixed crystals. Lehmann (Abstr., 1906, ii, 836, 837) has stated that cholesteryl propionate exists in two liquid crystalline modifications, but the author's results render this doubtful. The t. p. of cholesteryl propionate is 96·2°, the m. p. 112·7°. The freezing-point curve of the system *p*-methoxycinnamic acid (t. p. 170·6°, m. p. 185·5°) and *p*-azoxyphenetole, both of which form a stable, liquid-crystalline modification, is continuous, and shows a very distinct minimum. The curve along which the solid and liquid-crystalline phases are in equilibrium consists of two branches meeting in a eutectic point, as is the case in most of the other binary systems dealt with in the paper.

The freezing-point curve of the system *p*-azoxyanisole (t. p. 118·5, m. p. 135·5°) and *p*-azoxyphenetole falls regularly from the melting point of the latter to that of the former component. The melting point of the different mixtures is not sharp, but takes place over a range of about 0·6°. This phenomenon occurs also in most of the other systems, and is regarded as evidence that the liquid-crystalline modification of a substance is to be regarded as a homogeneous phase.

Cholesteryl benzoate and *p*-azoxyphenetole also form a continuous series of liquid mixed crystals with a minimum in the melting-point curve. No evidence was obtained of the occurrence of two non-miscible liquid phases in this case, as suggested by Lehmann. G. S.

Nature of Precipitated Colloids. II. HARRY W. FOOTE, S. R. SCHOLES, and RALPH W. LANGLEY (*J. Amer. Chem. Soc.*, 1909, **31**, 1020—1027).—In a previous paper (Abstr., 1908, ii, 821), experiments have been described which indicate that precipitated ferric and aluminium hydroxides may be regarded as solid solutions of water in the oxides or lower hydroxides. In drying the precipitates, a point was reached at which the product began to gain weight when placed over water, the composition at this point being that of the saturated solution.

This method of investigation has now been used to determine the composition of the saturated solutions of water in the mixed oxides of (1) iron and aluminium, (2) aluminium and silicon, (3) iron and silicon, and (4) aluminium and phosphorus, in order to ascertain the nature of the precipitates obtained when a solution of a soluble silicate or phosphate and an aluminium or ferric salt is treated with ammonium hydroxide. Precipitates of almost any desired composition can be obtained by varying the proportions of the salts employed. Many of these solutions have been described in the past as silicates or phosphates of aluminium or iron, but it is pointed out that there is no valid reason for regarding them as such.

The percentages of water in the mixed oxides when gain in weight first occurs are tabulated, and curves have been constructed in which the compositions of the mixed oxides are plotted as abscissæ and the amounts of water as ordinates.

The curve for the mixed oxides of aluminium and iron clearly suggests that the precipitate is a solid solution dissolving water, the mixture taking up more water than does either oxide alone. The curves for the precipitates containing the oxide of silicon or phosphorus are of the same type, and do not exhibit any break, thus affording evidence that all the precipitates should be regarded as solid solutions. The curve for aluminium oxide and phosphoric acid shows a decided drop at the point corresponding with $AlPO_4$, and it seems not improbable that this salt is actually formed. E. G.

The Equilibrium of the Reaction $H_2S + 2I = 2HI + S$ and the Dissociation of Hydrogen Sulphide. F. POLLITZER (*Zeitsch. anorg. Chem.*, 1909, **64**, 121—148).—The reaction between hydrogen sulphide and solid iodine takes place at the ordinary temperature, although the concentration of the hydrogen iodide produced is very small. Pure hydrogen sulphide, prepared from calcium sulphide and hydrochloric acid, is mixed with electrolytic hydrogen and brought into contact with solid iodine and sulphur contained in a U-tube at constant temperature, the whole being kept thoroughly dry. The escaping mixture passes through a vessel in which the iodine is condensed by cooling with solid carbon dioxide. Hydrogen iodide is absorbed in water and titrated, hydrogen sulphide absorbed in sodium hydroxide and weighed, and hydrogen measured by volume. The equilibrium constant is found to be $1 \cdot 90 \times 10^{-3}$ at 40° and $9 \cdot 96 \times 10^{-3}$ at 60°. The heat of reaction is calculated to be 17,200 cal., and the heat of formation of hydrogen sulphide to be 5000 cal., in agreement with the values determined calorimetrically. The heat of vaporisation of sulphur (forming S_2 molecules) at the ordinary temperature is found to be 28,500 cal.

Measurements have also been made of the solubility of hydrogen sulphide in water and in hydriodic acid at different concentrations and temperatures. The solubility increases considerably with the concentration of the hydrogen iodide. Measurements have also been made of the equilibrium in solution, and in the gas phase in contact with the solution. C. H. D.

Isomorphism of Ternary Mixtures in which the Components are not Completely Miscible. Ernst Jänecke (*Zeitsch. physikal. Chem.*, 1909, 67, 641—688).—A theoretical paper, which deals with the equilibria in ternary systems when the three independent components are isomorphous, but are not completely miscible in the solid and liquid state. The ternary systems in which the miscibility is incomplete in only one of the binary systems are discussed completely. There are eight chief types, and the several cases occurring in each are illustrated graphically. The more complicated cases in which there is incomplete miscibility in more than one of the binary systems are only partly dealt with.

In the second part of the paper, the ternary alloys of the metals: copper, silver, gold, chromium, manganese, iron, cobalt, nickel, palladium, platinum, are considered on the basis of the experimental data for the respective binary systems, due mainly to Tammann and his co-workers, and are referred as far as possible to the different types figured in the earlier part of the paper. G. S.

Equilibria in Quaternary Systems. The System: Water–Ethyl Alcohol–Sodium Chloride–Sodium Sulphate. Franz A. H. Schreinemakers and (Fräulein) W. C. de Baat (*Zeitsch. physikal. Chem.*, 1909, 67, 551—560). The equilibria in the above system have been determined by solubility measurements in the usual way. The results are complicated by the existence of sodium sulphate decahydrate, $Na_2SO_4,10H_2O$, under certain conditions.

The four ternary systems have mostly been investigated by previous observers, and the available data are amplified in some respects. The equilibria in the quaternary system have been examined at 15°, 25°, and 35°. The composition of the saturated solutions in equilibrium with the different solid phases are given in tabular form, and are also represented graphically. The results of the analyses of the saturated solutions have been confirmed by the "residue" method. The relationships are comparatively simple at 35°, as under these conditions the decahydrate of sodium sulphate does not exist. G. S.

Steric Hindrance III. Relation between the Structure of the Aliphatic Alcohols and Their Rate of Esterification. Arthur Michael and Karl Wolgast (*Ber.*, 1909, 42, 3157—3176. Compare this vol., ii, 220).—The authors' researches on the nature of steric hindrance lead them to a re-examination of this question. The work of Menschutkin is open to criticism, because the percentages of alcohol esterified in the first hour, which he termed the "initial velocities," are not proportional to the rates of esterification, since in many cases an appreciable quantity of water is formed in that time. The method selected for measuring the velocity of esterification was to determine at definite intervals the decrease of the acid titration of an alcoholic solution containing a known amount of the acid. Trichloroacetic acid was chosen as the acid, and was titrated with ammonia, rosolic acid being used as indicator. The results are summarised as follows, the values given being for $k \times 10^5$, in which k is the constant of the reaction calculated from the equation of the second order: $k = 1/t.x/A(a-x)$, A being the number of gram-molecules of acid to which 1 litre of alcohol is added, a the number of c.c. of $N/10$-ammonia required to neutralise 2 g. or 2 c.c. at the beginning, $a-x$ the amount required to neutralise the same quantity at time t. The values of k are either means of the series obtained from any one experiment, or, in cases where a regular increase or decrease in the value found for successive times was observed, the values extrapolated graphically for $t=0$.

Esterification with Trichloroacetic Acid at 25°.—Primary alcohols: Methyl alcohol, 3690; ethyl alcohol, 650*; propyl alcohol, 725; butyl alcohol, 1200; *iso*butyl alcohol, 740; heptyl alcohol, 1160; octyl alcohol, 1860; cetyl alcohol, 2500. Secondary alcohols: Dimethylcarbinol, 98; methylethylcarbinol, 90; methylpropylcarbinol, 76; methylhexylcarbinol, 109. Tertiary alcohols: *tert.*-Butyl alcohol, 118; *tert.*-amyl alcohol, 248.

Esterification with Trichloroacetic Acid at 50°.—Primary alcohols: Methyl alcohol, 24000; ethyl alcohol, 4210; cetyl alcohol, 16300.

In order to exclude the possibility that the results should be to any considerable degree dependent on the acid taken, a further series of measurements was made with acetic acid, the titration being effected with baryta and roselic acid as indicator.

Esterification with Acetic Acid at 50°.—Primary alcohols: Methyl alcohol, 808; ethyl alcohol, 159; *n*-butyl alcohol, 234; cetyl alcohol, 436.

The figures show that the relative rates of esterification are not greatly different at 25° and at 50°. The velocity of esterification of the normal primary alcohols increases as the carbon chain becomes longer. The first member, methyl alcohol, has an abnormally high rate. Menschutkin found the velocity of esterification constant from ethyl alcohol onwards. The increase is not an additive one, but a constitutive influence depending on the position of the methyl group. This conclusion is borne out by the authors' results for secondary and tertiary alcohols given above; these also differ considerably from the values obtained by Menschutkin. The decrease in velocity on passing from the primary series to the secondary is much greater than that observed by Menschutkin, whilst the velocities of esterification of tertiary alcohols, which Menschutkin found very much smaller than those of secondary alcohols, actually exceed them.

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* Mean from Kailan's experiments at 25° (compare Abstr., 1908, ii, 936).

The authors consider that the hypothesis that the rate of esterification depends on the spacial extension of the atoms in the reacting molecules (*Hypothese der Raumerfüllung*) is not consonant with the relations between the structure of the alcohols and the rates of esterification, which indicate, on the other hand, that the influence of the atoms in the alcohol molecule is not purely mechanical, but is dependent on their nature and position relative to the hydroxyl group. Their former conclusions (*loc. cit.*) are thus confirmed.

For the discussion of numerous points connected with the observations and calculations, the original paper should be referred to. Especial care was taken in the purification of the alcohols used, and the following physical data, etc., were obtained. The boiling points are corrected. Methyl alcohol, b. p. 64·4°/768·0 mm. Ethyl alcohol, b. p. 78·0°/762·0 mm. *n*-Propyl alcohol, b. p. 97·1—97·2°/760 mm. *n*-Butyl alcohol, b. p. 116·8—117·2°/755 mm. *iso*Butyl alcohol, b. p. 107·5—107·6°/759 mm. *sec.*-Amyl alcohol, b. p. 119·3—119·7°/768·0 mm. *tert.*-Amyl alcohol, b. p. 101·7—102·2°/763·8 mm. Heptyl alcohol, b. p. 175·0—176·0°/760 mm. *n*-Octyl alcohol, b. p. 194·5—195·5°/755 mm. *sec.*-Octyl alcohol, b. p. 179·5°/769 mm.

sec.-Butyl alcohol, prepared by the method of Sabatier and Senderens by reducing methyl ethyl ketone, was freed from admixed ketone as follows. The alcohol was left with phenylhydrazine for some hours, then fractionated with a Hempel column in a vacuum, the distillate treated with three to four drops hydrochloric acid, and after a time twice fractionated. The hydrochloric acid was finally removed by heating for some hours with lime. In the case of *iso*propyl alcohol and methylpropylcarbinol, the troublesome removal of the phenylhydrazine may be avoided by using semicarbazide instead. R. V. S.

Square Root of the Atomic Weights. ISIDOR TRAUBE (*Physikal. Zeitsch.*, 1909, 10, 667—670).—Bragg has shown that the stopping power of metals for α-rays is proportional to the square roots of the atomic weights, and that for gases it is proportional to the sum of the square roots of the weights of the atoms in the molecule. This stopping power is also approximately proportional to the molecular volumes of different substances at their respective boiling points. The relationship thus indicated between atomic weights and volumes has been investigated.

For a large number of organic and inorganic substances it is found that the molecular volume at absolute zero is proportional to the sum of the square roots of the atomic weights corresponding with the equation $v_0 = 2{\cdot}6\sqrt{\Sigma A}$. From dispersion and absorption measurements, Martens has shown that for a number of elements, the period of vibration of the atoms is proportional to the square root of the atomic weights. According to the above relationship, it then follows that these periods of vibration are approximately proportional to the volumes of the atoms.

The paper also contains a series of numbers which indicate proportionality between the sum of the square roots of the atomic weights and the sum of the maximum valencies of the atoms in the molecules of different substances. This relationship, however, does not hold good unless abnormally high valencies are assumed in certain cases.

H. M. D.

Dependence of the Valency on the Temperature in Heterogeneous Systems. Wilhelm Biltz (*Zeitsch. physikal. Chem.*, 1909, **67**, 561—593).—The dependence of valency on the temperature is discussed in the light of the available data for the dissociation equilibria of oxides, hydrates, and ammonia compounds at fixed pressures. In the case of the oxides, for example, the temperatures are given at which a higher and a lower oxide of the same metal are in equilibrium with oxygen at atmospheric pressure. When experimental data for atmospheric pressure are not available, the temperatures in question are calculated from the heat of the reaction, and the dissociation pressures at other temperatures by substitution in Nernst's equation connecting dissociation pressure and temperature. So-called valency isobars are then drawn, by taking the absolute temperatures as abscissæ and the valencies as ordinates. For example, the absolute temperature for the equilibrium PdO_2/PdO is 453° and for PdO/Pd 1148°, and a line drawn from the point representing valency four and 453° to that representing valency two and 1148° is the valency isobar. The points at which the valency horizontals meet the isobars are termed valency points of section. When more than two oxides exist, the isobars consist of two or more straight lines meeting at certain angles. Similar curves are constructed for the hydrates and ammonia compounds of certain salts, except that for the hydrates a dissociation pressure of 1/10 atmosphere is chosen.

From the results, the following rule is deduced. The valency isobars, independent of the absolute value of the valency and independent of its increase, ascend from the valency points of section the more steeply the lower the temperature. The tangents of the angles of inclination increase with falling temperature at first gradually, then more rapidly, and the relation between the temperature and the tangent of the angle of inclination of the isobars can be represented by a continuous curve for each of the three types of compound. When a substance shows more than two valencies, the isobar which joins the two lowest valency points of section is less inclined than the others. For compounds of the same type, the inclination of the valency isobars is constant for a definite temperature.

G. S.

Dependence of Valency on Volume in Certain Tervalent Elements. Albert Ludwig (*J. Amer. Chem. Soc.*, 1909, **31**, 1130—1136).—The author has observed (Abstr., 1902, ii, 451) that during the fusion of carbon under a high gaseous pressure the electrical conductivity ceases, and this he has regarded as an indication of a change of the carbon into the denser form of diamond. A fuller study of this change offers considerable difficulty on account of the high inversion temperature (over 3000°) and the extremely high pressure required. Experiments have therefore been made in order to investigate the volume changes of more easily fusible substances, and bismuth, antimony, and aluminium have been selected for the purpose.

The fused metal was placed in a heavy nickel-steel cylinder, fitted with a hardened steel piston. The metal was lightly covered with a magnesia plug, moistened with water, and a pressure of from 6000 to 17,000 atmospheres was suddenly brought to bear upon it. A rapid generation of gas immediately occurred. When the cylinder had cooled to the ordinary temperature, the pressure was released and the gas allowed to escape. In the cases of bismuth and antimony, after removing the metal by amalgamation with mercury, black powders were obtained, consisting of the oxides BiO and SbO. In the case of aluminium, the metal appeared but little changed. On breaking up the aluminium, however, the particles of metal immediately became covered with a peculiar, white, feathery substance, which is isotropic, has *n* 1·542, is easily soluble in acetic acid, and on ignition is converted into the oxide Al_2O_3. It is probable, therefore, that, like bismuth and antimony, aluminium is bivalent under high pressures, and forms the oxide AlO. It is also probable that, on account of its high m. p., the metal does not revert immediately to the less dense form, but only returns slowly after vigorous shaking or pounding, the pressure developed by the change causing the oxide to appear in the form of fine threads. E. G.

Sensitive Micro-balances and a New Method of Weighing Minute Quantities. BERTRAM D. STEELE and KERR GRANT (*Proc. Roy. Soc.*, 1909, *A*, 82, 580—594).—Two types of constant-load vacuum gravity micro-balance are described. The first is designed for the measurement of small alterations in weight, and is sensitive to one two-hundred and fifty-thousandth of a milligram; the second for absolute measurements of masses not exceeding 0·1 gram, with an accuracy of one ten-thousandth of a milligram.

The balances are enclosed in a brass case, consisting of base and cover, which are both provided with flanges carefully ground so as to make a vacuum tight joint. A side-tube, soldered into the case and provided with a manometer, enables the case to be connected with the atmosphere or with a vacuum pump. The beam, which is made of fused quartz, carries a small mirror, which is illuminated by a Nernst lamp through a plate-glass window in the cover. The zero position of the instrument is obtained by reading the position of the image on a millimetre scale. The beam has the form of a double triangle, which in the first type of balance oscillates about a central knife-edge ground upon the end of a quartz rod. Attached to one end of the beam is a small quartz bulb of known internal volume, containing air sealed up at known temperature and pressure. At the other end is a quartz counterpoise, the shape of which depends on the purpose for which the balance is intended. The final adjustment for balance and for the position of the centre of gravity is rendered possible by the fact that quartz is appreciably volatile in the oxygen coal-gas flame. To give an idea of the dimensions of the balance of the first type used by the authors, it may be mentioned that the total weight of the beam with attached mirror, bulb, and counterpoise is only 0·177 gram, the length of the arm 5·1 cm., and the volume of the bulb 0·00865 c.c.

The method of weighing, which depends for its successful application on the possibility of attaining perfect homogeneity in the beam of the balance, consists in employing as counterpoise the whole or any fraction of the weight of the air in the sealed quartz bulb. By adjusting the pressure in the balance case, it is obvious that the effective weight of the enclosed air can be made to vary between zero and the vacuum weight, and that at a given temperature a change in pressure of, say, 1 mm. of mercury will correspond with a definite variation of the effective weight and with a definite shift in the scale reading.

The balance of the first type was designed with the special object of measuring the loss of weight of radium salts during disintegration.

H. M. D.

Modified Form of Gooch Crucible. THEODORE W. RICHARDS (*J. Amer. Chem. Soc.*, 1909, 31, 1146).—When material is transferred from a flask or large beaker into a Gooch crucible, there is a danger that some of the substance may fall outside and thus be lost. This can be obviated by welding on to the crucible a flange or brim, sloping at an angle of about 45°. The diameter of the top of the crucible may thus be doubled. The flange also serves to stiffen the crucible and thus enable it to retain its form better. E. G.

Automatic Filter Funnel. HERBERT S. BAILEY (*J. Amer. Chem. Soc.*, 1909, 31, 1144—1145).—The apparatus described has been found very convenient as a substitute for the ordinary filter flask or bell-jar and beaker usually employed in filtering with suction.

The stem of the funnel containing the Gooch crucible passes through a rubber stopper, which is fitted into the mouth of a glass tube. This tube may be of any convenient size, and terminates in a narrow tube, which is constricted and provided with a small movable plug placed below the constriction and kept from falling out by two or three small projections on the inside of the tube. The plug is ground so as to close the constriction when pressed against its lower surface. The large tube is provided with a side-arm in order to connect it with the pump. When the action of the pump is discontinued and air is admitted through the side-tube, the plug drops and the filtrate is discharged into a suitable vessel placed to receive it. E. G.

Constant Level Reservoir. D. BASIL W. ALEXANDER (*J. Amer. Chem. Soc.*, 1909, 31, 1052—1053).—An apparatus is described which has been found useful for filtering solutions of bitumen in carbon tetrachloride. The liquid to be filtered is placed in a separating funnel, which is closed at the top by a stopper, and is so supported that the lower end is about half an inch above the felt of a Gooch crucible. As the liquid passes through the crucible, air ascends into the separating funnel, and further quantities of the liquid flow out until the whole has been filtered. E. G.

Lecture Experiment to Show the Rate of Chemical Action. Walther Nernst (*Ber.*, 1909, 42. 3178—3179).—The experiment depends on the following facts : (1) The different indicators show their characteristic colour changes at definite and different concentrations of hydrogen or hydroxyl ions ; (2) when a solution of an ester is treated with a little alkali, the alkalinity quickly vanishes, and, as a result of the hydrolysis of the ester, a gradually increasing acid reaction makes its appearance. If, therefore, 50 c.c. of boiled water are treated with enough barium hydroxide to make the solution about N-0·001, and then with 1 c.c. of methyl formate, an almost instant decoloration will be observed on addition of a trace of phenolphthalein. On addition of litmus, cyanine, *p*-nitrophenol, or methyl-orange, the times required for decoloration are respectively about 1, 15, 30, 120 minutes. The experiment may conveniently be shown with the different indicators simultaneously, the indicators being introduced into all the flasks at the same instant by being poured from a row of test-tubes fastened on a rod. R. V. S.

Inorganic Chemistry.

Absorption of Hydrogen by Colloidal Platinum and Palladium Solutions. Giuseppe Kernot and F. de Simone Niquesa (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], 15, 168—175). —Pure colloidal platinum and palladium solutions absorb much larger quantities of hydrogen than are taken up by the metals in any other physical condition, even by colloidal suspensions prepared by chemical means. A rough proportionality is found between the concentration of the colloidal metal and the volume of hydrogen absorbed. The absorption of hydrogen is considerably diminished by the presence of gum, dextrin, or albumin, but is not sensibly influenced by sucrose.

T. H. P.

Ice [Modification] III. Gustav Tammann (*Zeitsch. anorg. Chem.*, 1909, 63, 285—305).—Phases stable only at higher temperatures may be obtained in a metastable state at lower temperatures by sufficiently rapid cooling. It is now shown that phases stable only under high pressures may be obtained under low pressures by compressing isothermally, cooling to a temperature at which the velocity of transformation becomes negligible, and reducing the pressure. This method has been applied to water to obtain ice III, stable only under high pressures, under atmospheric pressure.

Ice I contracts on melting, and the equilibrium temperature of ice I and water therefore falls with increase of pressure. Ice III expands on melting, so that its melting point rises with increase of pressure. The difference in the specific volumes of ice I and III is very large, and the heat of transformation very small, passing through zero at −43°. The internal heat of transformation at this temperature is 9·4 cal., being exactly balanced by the external work. At −190° ice III can be obtained even when the pressure has fallen to that of the atmosphere, the transformation not setting in until −120° is reached.

The water in the experiments is enclosed in a paper cylinder, surrounded with light petroleum, in connexion with the pressure apparatus. The quantity of water used in each experiment is about 3·2 grams. The pressure is raised to 3000 kilograms, and, after cooling to the ordinary temperature, the vessel is cooled with solid carbon dioxide, causing freezing to ice III, with a corresponding fall of pressure. After cooling with liquid air, the pressure is lowered to 100 kilograms. On warming to −120°, an increase of pressure is observed corresponding with the transformation to ice I. It has been found possible to open the vessel under atmospheric pressure at −190° and to transfer the ice to liquid air, removing the paper. Ice III is clear and colourless, being built up of coarse crystallites. It has a porcelain-like appearance when undergoing transformation into ice I. It sinks at once in liquid air, whilst ice I floats. When removed from the liquid air, the transformation takes place rapidly, the mass falling into a bulky, white powder, which melts at 0°. Abnormal behaviour is observed when the paper cylinder is omitted, the whole vessel being filled with water, as in this case the uniform transmission of pressure is hindered.

Ice I, formed from water under ordinary pressure, must consist of polymerised molecules. Nordenskiold's tetragonal ice is only a crystalline modification of this. Ice III, formed at high pressures, must consist of simple molecules. Ice II must have the same molecular weight as ice III. There are thus two polymerised and two simple forms. Equilibrium can only exist between two modifications of different molecular weight. Modifications having the same molecular weight differ only in their space-lattice systems, not more than one of which can be stable. C. H. D.

Anodic Formation of Hydrogen Peroxide. E. H. Riesenfeld and B. Reinhold (*Ber.*, 1909, 42, 2977—2981).—The formation of hydrogen peroxide in the electrolysis of aqueous solutions has hitherto only been noticed at the cathode, its production being due to a secondary reaction. All attempts to prove its formation at the anode have failed. Theoretical considerations indicate that, if formed at all, it should be produced by the electrolysis of strongly alkaline solutions at low temperatures.

The authors find that there is no anodic formation of hydrogen peroxide when sodium hydroxide is electrolysed at any temperature down to −25°, the lowest temperature at which sodium hydroxide is liquid. On the other hand, when potassium hydroxide is used, there is an appreciable formation of hydrogen peroxide at all temperatures between 0° and −60°, the maximum amount being formed at −40°. The experiments were carried out in a U-tube, the anode consisting of a platinum wire, the cathode, of platinum foil, being surrounded by parchment paper.

The different action of the two alkalis is probably due to the fact that hydrogen peroxide is decomposed catalytically much more rapidly by sodium hydroxide than by potassium hydroxide. This is proved by experiments on the catalytic decomposition of hydrogen peroxide by these alkalis.

In all the experiments the solution at the anode became yellow in colour. This is not due to the formation of potassium ozonate (compare Baeyer and Villiger, Abstr., 1902, ii, 650), which then decomposes with the formation of hydrogen peroxide, since the intensity of the yellow colour continually increases with fall in temperature, whereas there is an optimum temperature for the formation of the hydrogen peroxide. Moreover, it is shown that the decomposition of potassium ozonate does not give rise to any appreciable quantities of hydrogen peroxide.

There is no formation of hydrogen peroxide at nickel electrodes, neither is a yellow colour produced. This is in accordance with the electrochemical behaviour of nickel as compared with platinum.

T. S. P.

Action of Colloidal Iridium Solutions on Hydrogen Peroxide. Giuseppe Kernot and F. Arena (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], **15**, 125—132).—When colloidal solutions of iridium in *N*/1000 sodium hydroxide are prepared, according to Bredig's method, the sodium hydroxide undergoes dissociation, and part of the hydrogen liberated is absorbed by the colloidal iridium, and causes a marked acceleration in the action of the latter on hydrogen peroxide. It is therefore preferable to employ pure water in place of the dilute alkali. The catalytic action of such solutions is intensified by the presence of an acid, and is greatly diminished or entirely destroyed by small proportions of mercuric chloride or potassium cyanide. T. H. P.

Influence of Potassium Persulphate on the Catalytic Decomposition of Hydrogen Peroxide by means of Colloidal Iridium Solutions. Giuseppe Kernot (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], **15**, 145—150. Compare preceding abstract).—The velocity of decomposition of hydrogen peroxide by colloidal iridium solutions is increased considerably by the presence of potassium persulphate, the increase being greater in neutral than in acid solution, and possibly proportional to the amount of persulphate. It may be that the latter acts only catalytically, the increase of the constant of the decomposition reaction being due to the formation of a compound, such as the potassium salt of Caro's acid, $OK\cdot S_2O_5\cdot O_2K$, more highly oxygenated and less stable than the persulphate or hydrogen peroxide; in such case, the following three reactions would be superposed: (1) catalytic decomposition of hydrogen peroxide; (2) reaction between the oxygen evolved from the peroxide and the persulphate, and (3) decomposition of the product of reaction (2). T. H. P.

Action of Colloidal Rhodium Solutions on Hydrogen Peroxide. GIUSEPPE KERNOT and F. ARENA (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], **15**, 157—166).—By means of Bredig's method, the authors have prepared colloidal solutions of rhodium in pure water (conductivity $1\cdot5—3\cdot0 \times 10^{-6}$), a current of 2 amperes at 110 volts being employed, and the capsule containing the water kept cooled. Such solutions, which have a reddish-brown colour and are extremely unstable, exert a marked catalytic activity towards hydrogen peroxide. Potassium persulphate or percarbonate accelerates the catalytic action, apparently owing to the formation of a highly oxygenated product more readily decomposable than hydrogen peroxide. Potassium perchlorate, perchloric acid, ammonium persulphate, and most other electrolytes exert a retarding influence on the catalysis. T. H. P.

Liquid Chlorine. FREDERICK M. G. JOHNSON and DOUGLAS MCINTOSH (*J. Amer. Chem. Soc.*, 1909, **31**, 1138—1144).—A study has been made of the vapour pressure, density, and molecular surface energy of liquid chlorine, and also of its behaviour as a conducting solvent. The apparatus employed is described with the aid of diagrams.

The vapour pressure has been determined at temperatures ranging from −105·7° to −32·0°. The results are almost identical with those obtained by Knietsch (Abstr., 1891, 14). The b. p., under atmospheric pressure, is −33·7°. At the f. p. the vapour pressure is 9·2 mm., showing the temperature to be −101·5°. By means of the Clausius formula, the heat of vaporisation at 760 mm. for 1 gram-mol. is found to be $21\cdot1 \times 10^{10}$ ergs.

The densities have been determined between −93·7° and −29·4°, and it is shown that the density at any temperature can be calculated by means of the formula $1\cdot725 - 0\cdot00243(100 + t)$. At the b. p. the density is 1·568, and hence the molecular volume is 22·6, which agrees with the value obtained by Kopp from organic compounds.

The molecular surface energy, determined by means of a modification of Ramsay and Shields' apparatus, is recorded for temperatures between −61·5° and −28·7°. Between these temperatures $d(MV)^{\frac{2}{3}}/dT = 2\cdot04$, and hence liquid chlorine has the formula Cl_2. The curve exhibiting the variation of molecular surface energy with temperature shows that the value of the molecular surface energy is zero at 129·4°.

No inorganic substance could be found which becomes ionised in liquid chlorine, but a mixture of ether and hydrochloric acid enables the liquid to conduct well, probably owing to the formation of the compound Et_2O,HCl. E. G.

Formation of Ozone by the Ultra-violet Rays. FREDERICK M. G. JOHNSON and DOUGLAS MCINTOSH (*J. Amer. Chem. Soc.*, 1909, **31**, 1146—1147).—Experiments have been made which show that Bordier and Nogier's statement (*Compt. rend.*, 1908, **147**, 354), that the odour observed in the neighbourhood of the mercury arc enclosed in quartz is not due to ozone, is incorrect. In all cases in which the odour is perceptible, the presence of ozone can be detected by means of potassium iodide and starch paper. E. G.

Specific Gravity and Percentage Strength of Selenic Acid. M. E. Diemer and Victor Lenher (*J. Physical Chem.*, 1909, **13**, 505—511).—Two methods for the preparation of pure selenic acid from selenium dioxide are described. A large number of density determinations of aqueous solutions containing the acid in proportions from 0 to 99·4% have been made, and the results are represented graphically and also in tabular form. Some of the interpolated results are as follows: 10·44%, D_4^{20} 1·080; 25·30%, D_4^{20} 1·215; 40·06%, D_4^{20} 1·385; 60·18%, D_4^{20} 1·680; 80·10%, D_4^{20} 2·120; 99·36%, D_4^{20} 2·595.
G. S.

Some Complex Selenium Anions. Arthur Rosenheim and Max Pritze (*Zeitsch. anorg. Chem.*, 1909, **63**, 275—281).—*Mercuric selenocyanate*, $Hg(SeCN)_2$, prepared from potassium selenocyanate and mercuric chloride, forms white needles, decomposed by hot water When only half the quantity of the potassium salt is used, pale yellow crystals of *mercuric chloroselenocyanate*, $HgCl(SeCN)$, are obtained, and may be recrystallised rapidly from water. Two other double *salts*, $KHg(SeCN)_3$ and $K_2Hg(SeCN)_4$, may be obtained in a crystalline form. A *cobalt* salt, $CoHg(SeCN)_4$, greenish-blue, microscopic crystals, and a white *zinc* salt, $ZnHg(SeCN)_4,H_2O$, have been prepared.

Mercuric oxide is insoluble in selenious acid, but *mercuric selenite*, $HgSeO_3$, may be obtained from mercuric oxide and sodium hydrogen selenite, or from mercuric nitrate and sodium selenite, in white crystals, insoluble in water or dilute nitric acid. For analysis, it is dissolved in hydrochloric acid, warmed with ammonium persulphate, and then boiled with sulphuric acid. After adding an excess of a solution of hydrogen sulphide and expelling the gas with carbon dioxide, the precipitated mercuric sulphide is free from selenium.

Two double salts, $Na_2Hg(SeO_3)_2$ and $HgCl\cdot SeO_3Na,2H_2O$, were prepared. The solubility of mercuric selenite in sodium selenite solutions was determined, and a constant calculated for the complex formation.
C. H. D.

New Compounds of Nitrogen with Hydrogen and Metals. Franz W. Dafert and R. Miklaux (*Monatsh*, 1909, **30**, 649—654. Compare Haber and Van Oordt, Abstr., 1905, ii, 159, 384, 814).—When calcium nitride is heated, within certain limits of temperature, in a stream of hydrogen, the latter is rapidly absorbed, and a lemon to orange-yellow substance is obtained, the approximate composition of which is: calcium 80·3%, nitrogen 17·1%, and hydrogen 2·6%. Although the analytical results are not quite conclusive, the new substance is probably tricalciumamide, $Ca_3(NH_2)_2$. It is scarcely affected by heating in nitrogen or hydrogen, but changes slowly in diffused light, rapidly in sunlight, to a greyish-black substance, probably a mixture of calciumimide and calcium hydride, formed according to the equation $Ca_3(NH_2)_2 = 2CaNH + CaH_2$. The amide, in an impure form, has also been prepared by heating calcium hydride in nitrogen.

Lithium nitride also absorbs hydrogen on heating, forming a white compound, probably trilithiumamide, Li_3NH_2. In sunlight it decomposes rapidly, giving rise to a red substance. The change is probably represented by the equation $Li_3NH_2 = Li_2NH + LiH$, the red compound being the previously unknown lithiumimide, Li_2NH.

Magnesium nitride does not show any tendency to unite with hydrogen. G. S.

Reductions with Phosphorous and Hypophosphorous Acids. Adolf Sieverts [with Moriz Major] (*Zeitsch. anorg. Chem.*, 1909, **64**, 29—64).—Ferric alum reacts with hypophosphorous acid at the temperature of the water-bath, whilst phosphorous acid is not attacked after several hours. A separation of the two acids by titrating the ferrous salt thus formed with permanganate is, however, impossible, as phosphorous acid is readily oxidised by permanganate in presence of a ferrous salt. The author has therefore only determined the iodine value of the solutions by means of iodine and arsenious acid. Both acids are only very slowly oxidised by air, and it is not necessary to exclude air during titration. By oxidising with bromine to phosphoric acid, and estimating this and comparing the result with the iodine value, the two acids may be estimated when present together.

Gold chloride is reduced by both acids to metallic gold. The precipitate oxidises a boiling solution of hypophosphorous acid slowly, evolving hydrogen.

[With Wilhelm Krumbhaar.]—Silver behaves similarly when the phosphate is used, dissolved in phosphoric acid; the nitrate causes complications, owing to reduction of the anion. Even in ammoniacal solution, the precipitate consists of metallic silver, and not of a suboxide, and there is no evidence of the formation of silver hydride (Bartlett and Rice, Abstr., 1897, ii, 212). Phosphorous acid reduces copper sulphate to copper; phosphates are without action. Cupric chloride is reduced to cuprous chloride. The acid is readily oxidised by air in presence of a cupric salt. Hypophosphorous acid, with the copper in excess, precipitates metallic copper without evolution of hydrogen; with an excess of sodium hypophosphite, cuprous hydride, CuH, is precipitated. In all cases the reduction is first to a cuprous salt.

Platinum salts are not reduced by hypophosphites, even on boiling, and the oxidation caused by platinum-black is due only to retained oxygen. Palladium salts, on the other hand, are reduced by both acids in the cold. Even a cold solution of sodium hypophosphite is oxidised by precipitated palladium to phosphite, and even further on boiling. Alcoholic sodium hypophosphite does not react with palladium.

Nickel and cobalt salts are not reduced, but the metals prepared by the action of hydrogen on the oxides behave like palladium. Reduced iron dissolves readily in sodium hypophosphite solution on heating.

C. H. D.

Reducing Action of Silicon. Émile Vigouroux and F. Ducelliez (*Bull. Soc. chim.*, 1909, [iv], **5**, 868—869).—In an attempt to free amorphous silicon from aluminium, with which it was contaminated, the substance was heated to dull redness, or slightly beyond, with twice its weight of potassium hydrogen sulphate. A vigorous action took place, and the resulting product when cold had a strong odour of hydrogen sulphide, and contained yellow crystals of potassium sulphide, silica, alumina, potassium silicate, and unchanged silicon. In using potassium hydrogen sulphate to remove aluminium from crude silicon, the two products should be kept at a temperature below a red heat. T. A. H.

The Silicic Acids. Gustav Tschermak (*Zeitsch. anorg. Chem.*, 1909, 63, 230—274).—The method of determining the velocity of dehydration of the silicic acids (Abstr., 1905, ii, 816) has been applied to the study of a number of such acids, a vessel containing water being placed under similar conditions to the specimen, and its loss of weight also determined, in order to eliminate accidental changes in the rate of evaporation.

The rate of loss of water depends on the physical condition of the preparation, powdery and gelatinous silicic acids behaving differently. The absolute weight is also of influence, a large mass losing water relatively more slowly than a smaller mass. After the break in the dehydration curve has been passed, all the preparations behave similarly. This break occurs at a quite definite water-content, which is characteristic of each silicic acid. It is not identical with the break in Van Bemmelen's vapour-pressure curves (Abstr., 1908, ii, 838), and the trustworthiness of the author's method is maintained. Water-glass, which is an indefinite mixture of silicates, yields silicic acids with variable critical points on the dehydration curves.

The gel obtained from silicon tetrachloride and water consists of orthosilicic acid, and not of anhydrous silica, as suggested by Le Chatelier (Abstr., 1908, ii, 1033). Its hardness is only that of gypsum. The density of the silicic acids is also greater than that calculated on the assumption that they are mechanical mixtures of silica and water. Water is taken up by the dehydrated acids, but not to the amount of that originally present. If previously dehydrated over sulphuric acid, the silicic acid develops heat in becoming hydrated, but if ignited, no measurable heat development takes place, although a hydrate is slowly formed. The different silicic acids are unequally reactive towards alkalis, but quantitative relations have not been established. A combination of the hydrate and adsorption hypotheses is proposed to account for the behaviour of the silicic acids. The break in the dehydration curve indicates the composition of the acid derived from the silicate, except that differences of molecular weight, indicated by differences of physical structure, may also occur. Thus the acid from anorthite is represented as H_2SiO_3, and that from leucite as $(H_2SiO_3)_2$. Diopside may resemble leucite in this respect, and these minerals are not to be regarded as simple metasilicates. The place of aluminium in complex silicates is also discussed. C. H. D.

Search for the Heavier Gases of the Helium Groups in Minerals. C. F. Hogley (*Phil. Mag.*, 1909, [vi], 18, 672—677).—The inert gases evolved on heating certain minerals either alone or with potassium hydrogen sulphate have been examined. The gas obtained from malacone consists almost entirely of helium, the volume of argon present being less than 1%. The search for krypton in the helium evolved from fergusonite shows that, if present at all, the amount of krypton is less than one-millionth of the helium content. H. M. D.

Acid Sulphates. IV. JOH. D'ANS (*Zeitsch. anorg. Chem.*, 1909, **63**, 225—229. Compare this vol., ii, 139).—The examination of solutions containing potassium sulphate and sulphuric acid at 25° shows that a salt, crystallising in needles, exists between $K_3H(SO_4)_2$ and $KHSO_4$, having the composition $K_2SO_4,6KHSO_4,H_2O$, losing the water readily and completely at 180°. It appears to be identical with Stortenbecker's salt (Abstr., 1903, ii, 143). No other intermediate salt exists at 25°. A second definite salt, unstable at 25°, has a small region of stability at 18°, extending at lower temperatures. It probably has the composition $K_2SO_4,3KHSO_4$ (compare Arzalier, Abstr., 1908, ii, 763). C. H. D.

Application of Electrolysis in Inorganic Chemical Manufactures. BERNHARD LEPSIUS (*Ber.*, 1909, **42**, 2892—2916).—A lecture before the German Chemical Society dealing with the history of the practical application of electrolysis to the manufacture of sodium hydroxide and chlorine and allied products on a large scale. E. F. A.

The Fittig Reaction and the Dark Blue Sodium Bromide Resulting from Sodium and Bromobenzene. ERNST MOHR (*J. pr. Chem.*, 1909, [ii], **80**, 315—319).—The dark blue substance which is usually produced in the Fittig reaction has been isolated and examined. Sodium wire (1 atom) is pressed into a large test-tube half-filled with dry ether, dry bromobenzene (>3 mol.) is added, and the mixture is heated on the water-bath for eight hours at 45—55°. The liquid is decanted, and, with as complete exclusion of air as possible, the dark blue, heavy powder is washed with dry ether, dried at the pump for fifteen minutes, and kept in dry air, in which it remains unchanged for weeks. Two estimations of the bromine in different specimens showed the presence of 98·3 and 91·3% of sodium bromide; the remaining percentage is attributed to organic matter which cannot be removed by ether. The suggestion is advanced that the colour may be due to finely-divided sodium or to sodium subbromide, Na_2Br. The question whether sodium phenyl is an initial product of the Fittig reaction is also discussed. C. S.

Formation and Decomposition of Mixed Crystals of Alkali Nitrates and Nitrites. GIUSEPPE BRUNI and D. MENEGHINI (*Zeitsch. anorg. Chem.*, 1909, **64**, 193—199).—The freezing-point curve of mixtures of sodium nitrate and nitrite has a minimum at 50% $NaNO_3$ and 221·5°. The salts form two series of solid solutions, and there is a break in the curve at 37% $NaNO_3$. The end of the crystallisation is not readily determined by thermal means, but by isolation of the solid phase by means of van Eyck's apparatus (Abstr., 1900, ii, 403) and analysis, the limits of the gap are found to be 29·5 and 35% $NaNO_3$. The minimum thus falls within the region of the second series of mixed crystals.

Mixed crystals of sodium nitrate and nitrite are not formed by crystallisation from a solution of the mixed salts in water. The heat of solution of the mixed salts in water is that calculated from the heats of solution of the pure salts, whilst that of the rapidly cooled mixed crystals is considerably different, indicating that decomposition of the mixed crystals into their compounds takes place at temperatures below the freezing point. This resolution is hastened by the presence of moisture. C. H. D.

True Atomic Weights. Stas' Determinations. III. Louis Dubreuil (*Bull. Soc. chim.*, 1909, [iv], 5, 852—859, 860—865).—In these two papers the investigations already outlined (Abstr., 1908, ii, 936, 1035; this vol., ii, 475, 563, 654) are extended to the cases of silver iodide and silver bromide, and Stas' methods and results are critically reviewed. From the data obtained by Stas in the synthesis of silver iodide by three different methods, it is shown that the recalculated values of the apparent atomic weights of silver are 108·032, 108·0262, and 108·0278, whilst those for iodine are 126·9928, 126·9769, and 126·9756 respectively.

In the case of silver bromide, Stas employed two methods, and the recalculated apparent atomic weights deduced from these results are: for silver, 107·9933 and 107·9943, and for bromine, 80·0091 and 80·0077 respectively. T. A. H.

Solubility of Silver and of its Alloys in Mixtures of Acids. Ernesto Pannain (*Gazzetta*, 1909, 39, ii, 234—239).—Pure silver is insoluble in dilute sulphuric acid, and the same is the case with an alloy of 5 parts of silver with one part of copper, whilst pure boiling sulphuric acid does not dissolve silver except when it has the density 60°Bé. The presence of impurities may, however, determine the attack of the metal, even by dilute acids. For the industrial separation of silver and gold, sulphuric acid of density less than 60°Bé should not be employed, the action of this acid on the silver being facilitated by the presence of nitric acid. If a mixture of these two acids is used, the silver dissolves at a comparatively low temperature, and the amount of nitric acid used up is only one-half of that required to dissolve the silver in absence of sulphuric acid. In the treatment of alloys of silver with dilute sulphuric acid, either for the whitening of coins or manufactured articles, or for the separation of silver from base metals, it is essential that such impurities as occur in commercial sulphuric acid or well-water should be absent from the acid, otherwise the action of the latter will not be confined to the base metals. T. H. P.

Investigation of the Eutectic Mixture of Silver and Ammonium Nitrates by the Method of Melting. Flavian M. Flawitzky (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 739—743).—The author has studied the eutectic mixture of silver and ammonium nitrates by the method previously employed in investigating cryohydrates (*ibid.*, 1896, 28, 424). The eutectic mixture contains 48·75% $AgNO_3$, and was collected at the temperature 102·4°; Zawidzki (Abstr., 1904, ii, 389) found that the eutectic mixture of these two salts solidified at 100·8—101·5°.

The mean composition of the eutectic mixture is $AgNO_3 + 2{\cdot}232NH_4NO_3$, corresponding with 30·94 mol. % of silver nitrate. The ratio of the molecular depressions of melting point for the two salts in the mixture is calculated to be 1·43 or nearly 1·5, and, assuming that the salts polymerise to $(AgNO_3)_3$ and $(NH_4NO_3)_2$, the mixture should consist of $AgNO_3 + 2{\cdot}283NH_4NO_3$, corresponding with 30·46 mol. % of silver nitrate. This complex composition, which approximates to $4AgNO_3,9NH_4NO_3$, may be explained by the existence of the double salts, $AgNO_3,NH_4NO_3$, $AgNO_3,2NH_4NO_3$, and $AgNO_3,3NH_4NO_3$, the conditions of stability of these being different in the solid and fused states; in the solid state only the compound $AgNO_3,NH_4NO_3$ is known. The m. p. of $AgNO_3,3NH_4NO_3$ is calculated to be 145·7°, and that of $AgNO_3,2NH_4NO_3$, 8·6°. T. H. P.

Preparation of Silver Dimercurous Arsenate and Phosphate. JULES JACOBSEN (*Bull. Soc. chim.*, 1909, [iv], 5, 947—950).—*Silver dimercurous arsenate*, $AgHg_2AsO_4$, forms orange-red crystals, each consisting of four associated monoclinic crystals approaching rhombic symmetry. It is obtained by adding hydrogen peroxide solution, freed from chlorides, to a solution of silver nitrate, mercurous nitrate, and potassium arsenite in dilute nitric acid.

Silver dimercurous phosphate, $AsHg_2PO_4$, occurs in yellowish-white, hemimorphic, rhombic prisms or rhombic tablets, and is obtained by adding disodium hydrogen phosphate to a solution of mercurous nitrate and silver nitrate in very dilute nitric acid. The precipitate first formed is crystallised by dissolving in the minimum quantity of nitric acid and then diluting with water. Both salts are blackened by ammonia, and liberate free mercury.

Attempts to replace (1) the silver, and (2) the mercury by lead in these salts were unsuccessful. T. A. H.

Complex Salts of Glucinum and Zirconium. SEBASTIAN M. TANATAR and E. K. KUROVSKI (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 813—815).—The action of sodium tungstate on glucinum chloride or nitrate leads to the precipitation of complex salts of more or less basic character, depending on the conditions. Two such salts have been prepared, containing (1) 14·55% GlO and 79·30% WO_3, and (2) 24·61% GlO and 57·26% WO_3, and both having formulæ of the type: $xGlX_2,yGlWO_4,zGlO$. The following complex salts have also been prepared: (1) $ZrCl_4,2Zr(WO_4)_2,2ZrO_2$; (2) $xGlCl_2,yGl_3(VO_4)_2,zGlO$; (3) $xGl(NO_3)_2,yGl_3(VO_4)_2,zGlO$; (4) $xZrCl_4,yZr_3(VO_4)_3,zZrO_2$, together with glucinum and zirconium molybdates, $GlMoO_4$ and $Zr(MoO_4)_2$.

T. H. P.

Hydrates of Magnesium and Zinc Nitrates. ALEXIS VASILIEFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 744—748. Compare Funk, Abstr., 1899, ii, 209).—Magnesium nitrate forms hydrates containing

2, 6, and, probably, $9H_2O$, whilst with zinc nitrate there exists, in addition, a hydrate with $4H_2O$. This observation is in harmony with the less marked metallic character of zinc compared with magnesium, which explains the fact that zinc nitrate readily loses nitric acid even at the ordinary temperature, whilst $Mg(NO_3)_2,6H_2O$ does not decompose, but, on heating, loses 4 mols., possibly more, of water. The dihydrates of these salts correspond with the first anhydride of orthonitric acid, $NO(OH)_3$, and may be represented thus: $Zn[O{\cdot}NO(OH)_2]_2$, whilst the tetrahydrates correspond with orthonitric acid, $N(OH)_5$, for example, $Zn[O{\cdot}N(OH)_4]_2$. T. H. P.

Investigation of the Interactions between the Hydrates of Zinc or Magnesium Nitrate by the Method of Cooling Mixtures. ALEXIS VASILIEFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 748—753).—The author has investigated the interactions occurring between the two members of each of the following pairs of hydrates: (1) $Mg(NO_3)_2,6H_2O$ and $Mg(NO_3)_2,2H_2O$; (2) $Zn(NO_3)_2,6H_2O$ and $Zn(NO_3)_2,4H_2O$; (3) $Zn(NO_3)_2,4H_2O$ and $Zn(NO_3)_2,2H_2O$. The results are as follows:

(1) In this case, interaction took place at the constant temperature, 54·5°, the mixture flowing away at this temperature containing 18·16% MgO, corresponding with $Mg(NO_3)_2,4{\cdot}1H_2O$. The break in the curve hence occurs at about 55°, and not at 67° as stated by Funk (Abstr., 1899, ii, 209). According to Flawitzky's law (Abstr , 1906 ii, 152), which states that in cryohydrates or eutectic alloys the depressions of the melting points of the constituent parts are inversely proportional to their chemical masses, the composition of the mixture, m. p. 54·5°, should be $Mg(NO_5)_2,4{\cdot}193H_2O$, which is in good agreement with the experimental result.

(2) With hexa- and tetra-hydrated zinc nitrates the temperature of interaction is 35·4°, and the composition of the product obtained, $Zn(NO_3)_2,5{\cdot}5H_2O$; the composition calculated by means of Flawitzky's law being $Zn(NO_3)_2,5{\cdot}496H_2O$.

(3) Here the temperature of interaction is 38·4°, and the composition of the mixture, $Zn(NO_3)_2,3{\cdot}138H_2O$, the calculated composition being $Zn(NO_3)_2,3{\cdot}173H_2O$. T. H. P.

Alloys of Lead and Tin. P. N. DEGENS (*Zeitsch. anorg. Chem.*, 1909, 63, 207—224. Compare Rosenhain and Tucker, Abstr., 1908, ii, 1038).—The lead-tin eutectic point is found to lie at 181° and 24·4 atomic % Pb. Tin retains only 0·21 atomic % of lead in solid solution, whilst lead retains 12 atomic %, or possibly more, of tin. A transformation at 146° is found, having a maximum duration at 57 atomic % Pb. Experiments with an air dilatometer confirm the thermal results, the transformation being observed in all alloys containing 0—88 atomic % Pb. Microscopically, the occurrence of the transformation in cooling is marked by the appearance of a constituent distributed through the lead. The existence of a compound formed from solid lead and tin at 146° is suggested, but the formula is unknown. C. H. D.

Red Lead. II. Jaroslav Milbauer (*Chem. Zeit.*, 1909, **33**, 950—951, 960—961. Compare this vol., ii, 574).—More rapid rotation of the containing tube reduces the yield of red lead, owing to the formation of lumps. The previous heating of the air or oxygen supplied is practically without influence. The presence of impurities (alkalis, lead, silver, or copper oxides) has practically no effect on the velocity of reaction; bismuth and zinc retard the oxidation. Dilution with an inactive substance reduces the velocity, the action being mechanical. The yield of red lead from lead carbonate amounts to 89·9% after three hours' heating, and is not increased when the heating is continued for seven hours; the reaction occurs, however, at lower temperatures than when lead oxide is used, the maximum velocity being at 450°. Decomposition of the red lead sets in above 470°. C. H. D.

Action of Lead Oxide and some Lead Salts on Concentrated Solutions of Magnesium Chloride and a New Process for Making White Lead. Hans Hof (*Chem. Zeit.*, 1909, **33**, 1077—1078. Compare Abstr., 1887, 446; 1891, 151; 1904, ii, 336; 1908, ii, 946; this vol., ii, 668).—A boiling concentrated solution of magnesium chloride dissolves considerable quantities of lead oxide; for example, 1 litre of a solution of specific gravity 1·32 will dissolve 50 grams of lead oxide. If the oxide contains carbonate, a pasty mass of basic carbonate of magnesium is precipitated at the same time. Lead carbonate and also the basic carbonate will dissolve in a cold concentrated solution of magnesium chloride; if the solution so obtained is heated to 80° the lead carbonate decomposes with the evolution of carbon dioxide and precipitation of basic carbonate of magnesium. The filtrate, on cooling, deposits a double chloride of lead and magnesium, which has the composition $2MgCl_2,PbCl_2,13H_2O$, and is decomposed by water. The same double chloride is at first deposited when the hot saturated solution of lead oxide in concentrated magnesium chloride is allowed to cool, but after some days the whole solidifies to a mixture of the double chloride and a magnesium oxychloride, $MgCl_2,5MgO,13H_2O$.

In order to make white lead from this mixture, it is suspended in water and heated to such a temperature that the magnesium oxychloride is decomposed, being well stirred meanwhile. Lead oxychloride is formed at the same time, and this treatment is continued until the filtrate from a cooled portion of the mixture shows only a trace of lead. The mixture of lead oxychloride and magnesium hydroxide is then filtered from the mother liquors, again suspended in water, and the suspension treated with carbon dioxide at steam heat, until a neutral reaction is obtained. The reaction is complete in about four hours, and with proper precautions a pure white, chlorine-free basic carbonate of lead is produced, which has a high covering power. The process can be used with litharge containing the oxides of iron or copper, since these are without action on the solution of magnesium chloride; the copper must not be present as cuprous oxide.

Zinc oxide is slightly soluble in a hot concentrated solution of magnesium chloride, but zinc carbonate has no effect on the colour of white lead, so that litharge containing zinc may be treated in the above manner. Lead sulphate also dissolves in hot concentrated magnesium chloride solution, but on cooling the double chloride of lead and magnesium separates. By appropriate treatment, after the addition of milk of lime in order to produce the necessary quantity of magnesium hydroxide, this double chloride may also be converted into white lead. T. S. P.

Lead Silicates. SIEGFRIED HILPERT and PAUL WEILLER (*Ber.*, 1909, 42, 2969—2977. Compare Abstr., 1907, ii, 870).—The freezing-point curve of mixtures of lead oxide and silica in varying proportions has been investigated. Lead oxide melts at 776°, and the increasing addition of silica lowers the melting point until the eutectic temperature, 675—685°, is reached, corresponding with 24 mols. % SiO_2. Over this portion of the curve the melting points were readily obtained from the cooling curves, but immediately the eutectic composition was passed, crystallisation took place so slowly that the method of thermal analysis was of no value; with the ordinary rate of cooling, the fused mass solidified to a glass. When the cooling took place sufficiently slowly, however, the point at which crystallisation occurred could be told by direct observation of the fused mass; the results thus obtained were checked by observing the behaviour of the crystallised substance on heating.

The curve does not show the existence of an orthosilicate,

$$2PbO,SiO_2,$$

but gives a maximum (770°) corresponding with the metasilicate, PbO,SiO_2. A second eutectic past this maximum could not be observed, since with more than 52 mols. % of silica the fused mass always solidified as a glass. This glass zone exists, at all events, as far as the composition $2PbO,3SiO_2$, and in order to obtain thin-fluid fusions, it is necessary to raise the temperature to above 1000°. These silicates with high melting points become cloudy on cooling, and take on the appearance of enamel. Only in the case of the silicate $2PbO,3SiO_2$ could crystals be detected; these crystals were not silica, and it is therefore probable that a lead silicate exists which is richer in silica than the metasilicate.

The specific volumes of the lead silicates investigated were always higher than according to the ordinary rule of mixing. The crystallised metasilicate has D 6·36; the amorphous has D 5·93; the crystals are biaxial, and belong either to the rhombic or the monoclinic system. The refractive indices of glasses rich in lead are very high; for example, that of a glass with the composition $2PbO,SiO_2$ is 2·07 for sodium light. The glasses also show complete absorption in the violet and ultraviolet. The orthosilicate glass is dark yellow, the metasilicate, light yellow; the colour darkens with rise in temperature.

All the basic fusions up to and including the metasilicate easily dissolve in mineral acids and in acetic acid, silica being deposited. With increasing content of silica, they are less readily attacked, so that one of the composition $PbO,2SiO_2$ must be dissolved in hydrofluoric acid.

Lead oxide and silicates richer in lead than the metasilicate are reduced by hydrogen at 240°. With the meta and higher silicates, reduction only begins above 300°. T. S. P.

The Solubility of Cuprous Iodide. MORITZ KOHN (*Zeitsch. anorg. Chem.*, 1909, 63, 337—339).—It is stated in several text-books that cuprous iodide is insoluble in cold potassium bromide solution. This is erroneous; cuprous iodide dissolves readily in solutions of potassium bromide, to an extent increasing considerably with the concentration. The solutions undergo change in the course of a few days, iodine being set free, the solubility of the cuprous iodide not being markedly affected. C. H. D.

The Supposed Copper Quadrantoxide. L. MOSER (*Zeitsch. anorg. Chem.*, 1909, 64, 200—214).—The green precipitate obtained by Rose by the reduction of copper sulphate with an alkaline stannous solution, and regarded by him as the oxide Cu_4O, consists of cuprous oxide and copper. The precipitate is analysed after washing with warm water out of contact with air by dissolving in dilute nitric acid and estimating the total copper electrolytically. The cuprous copper is estimated by dissolving in dilute sulphuric acid.

Similar results are obtained by the action of alkaline stannous sulphate on copper sulphate or on precipitated cuprous oxide, and also by the action of sodium hyposulphite on cupric salts. It is also impossible to prepare a suboxide by igniting copper oxalate in a current of carbon dioxide. C. H. D.

The Resolution of Ytterbium. FRANZ WENZEL (*Zeitsch. anorg. Chem.*, 1909, 64, 119—120).—A statement in support of Welsbach's priority in the resolution of ytterbium into two elements, as against Urbain. C. H. D.

Liquidus Curves of the Ternary System: Aluminium–Copper–Tin. JOHN H. ANDREW and C. A. EDWARDS (*Proc. Roy. Soc.*, 1909, *A*, 82, 568—579).—From the form of the liquidus curves, it is clear that no ternary compound is deposited from any liquid alloy containing aluminium, copper, and tin. The behaviour of the aluminium and copper towards tin indicates, in fact, that the system may almost be considered as a binary series of alloys. This is seen by a comparison of the freezing-point curves of alloys which contain a constant percentage of tin.

Independently of the tin concentration, the curves are very similar to that which represents the behaviour of copper aluminium alloys. The data indicate further that the compound Cu_3Al is quite stable in presence of tin, and that this is insoluble in the majority of the alloys H. M. D.

The Amount of Sulphur in Electrolytic Iron. AUGUST PFAFF (*Zeitsch. Elektrochem.*, 1909, 15, 703—705).—Three samples of electrolytic iron were made by electrolysis of 6, 12, and 13% ferrous sulphate solutions at 70—95°, using iron containing 0·03% of sulphur as anode and a cathodic current density of 2 amperes per sq. dcm. Two other samples were made from 2% ferrous ammonium sulphate solution at 30°. The quantity of sulphur found by dissolving the deposit in hydrochloric acid and collecting the hydrogen sulphide evolved in ammoniacal hydrogen peroxide varied from 0·0002 to 0·0008%.

T. E.

Influence of Foreign Substances on the Diagram of Condition of the Alloys of Iron and Carbon. Paul Goerens (*Zeitsch. Elektrochem.*, 1909, 15, 617—634).—The construction of three dimensional models showing, not only the temperatures at which crystallisation begins in mixtures of three components, but also the secondary changes in the solid is discussed, Charpy's results for the system lead–tin–bismuth being taken as an example. When manganese, silicon, chromium, nickel, or tungsten is added to a mixture of iron and carbon, the arrests on the cooling curve are merely displaced; the addition of phosphorus, tin, arsenic, or antimony, on the other hand, gives quite a new set of arrests on the cooling curve. The systems manganese–iron–carbon and phosphorus–iron–carbon are discussed very fully with the help of a number of diagrams and microphotographs of sections. The greater part of the data used have already been published (compare Abstr., 1908, ii, 1041, 1042, and this vol., ii, 241). T. E.

Electrical Conductivity of Ferric Sulphate Solutions. Roger C. Wells (*J. Amer. Chem. Soc.*, 1909, 31, 1027—1035).—When a solution of ferric sulphate is diluted, a precipitate gradually forms, which is usually regarded as a basic salt. Cameron and Robinson (Abstr., 1908, ii, 112) have shown that such precipitates have not a definite composition. The present investigation was undertaken with the object of tracing the changes which take place when a solution of ferric sulphate is diluted.

The results show that at low dilutions the conductivity is abnormally low, whilst at high dilutions it is abnormally high. As the dilution increases, a precipitate is produced, the rate of its formation increasing enormously with rise of temperature. The conductivities of the solutions at 0°, 25°, and 30° before the production of the precipitate have been determined by direct measurement at low dilutions and by extrapolation at high dilutions. The values obtained indicate that ferric sulphate begins to undergo hydrolysis at a dilution of a few litres. It is suggested that the hydrolysis takes place in two stages, the first occurring with great rapidity, but without the formation of a precipitate, and the second at a measurable rate and accompanied with the production of the so-called "basic salt." E. G.

Phosphorus Compounds of Cobalt. S. F. Schemtschuschny and I. Schepeleff (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 862—875).—The authors have investigated the melting-point curve of alloys of cobalt and phosphorus, and also the microstructure of several of the solidified products. The results obtained indicate the existence of dicobalt phosphide, Co_2P, which has a hardness of about 6, those of cobalt and phosphorus being 4 and 0·5 respectively; this increased hardness may be connected with the considerable contraction which occurs on formation of the compound. The values of D are for Co_2P, 6·3—6·6; for Co, 8·5—8·9, and for P, 1·8—2·3. The compound exhibits magnetic properties, which are less intense than for cobalt or the alloys intermediate to Co and Co_2P. Increase of the proportion of phosphorus beyond that corresponding with Co_2P leads to the formation of non-magnetic compounds, such as Co_2P_3. T. H. P.

Nickel and Cobalt Chromates. SAMUEL H. C. BRIGGS (*Zeitsch. anorg. Chem.*, 1909, **63**, 325—329. Compare Abstr., 1908, ii, 113; Gröger, *ibid.*, 690; Schulze, Abstr., 1896, ii, 24).—Nickel and cobalt chromates are insoluble in water, like the chromates of copper, zinc, and cadmium, and are not precipitated from nickel and cobalt solutions; they must therefore be polymerised.

Nickel chromate, $NiCrO_4$, is obtained by heating a solution of 6·5 grams of nickel carbonate and 10 grams of chromium trioxide in 10 c.c. of water in a sealed tube to 260° for several hours. The solid is collected and washed with water, alcohol, and ether. It forms black crystals, insoluble in hot dilute nitric acid, and only slowly attacked by concentrated nitric acid or aqua regia. For analysis, it is fused with sodium and potassium carbonates, forming nickel oxide and alkali chromate.

Cobalt chromate, $CoCrO_4$, prepared in a similar manner at 185°, forms greyish-black crystals, readily soluble in hot dilute nitric acid. For analysis, mercurous nitrate is added, and the cobalt precipitated from the filtrate by alkali.

Cobalt chromate dihydrate, $CoCrO_4,2H_2O$, obtained from cobaltic acetate and potassium chromate in an attempt to prepare complex cobaltic chromates, forms bronze-coloured prisms or leaflets, always mixed with some double chromate. C. H. D.

Stability and Reactions of Uranyl Chloride. WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1909, 836—837).—Uranyl chloride is stable in a perfectly dry atmosphere. An aqueous solution, if air is excluded, slowly deposits a small quantity of uranic hydroxide, which after some time partly redissolve. The decomposition is more rapid in presence of air. No evidence has been obtained of the formation of chlorouranic acid, $UO_2Cl·OH$.

W. O. W.

Action of Uranic Sulphate on Calcium Carbonate. WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1909, 838—843).—Uranic sulphate and calcium carbonate interact when covered with water, or when a mixture of the two salts is fused, triturated in a mortar, or compressed. Analytical details of experiments are given, from which it appears that 19·97—29·33% of the calcium carbonate is converted into calcium sulphate under these conditions.

W. O. W.

Nature of Certain Sodium Uranium Compounds. FLOYD J. METZGER and M. HEIDELBERGER (*J. Amer. Chem. Soc.*, 1909, **31**, 1040—1045).—This investigation was undertaken with the object of ascertaining whether the final product obtained in the estimation of uranium by Patera's method (*K. k. Geol. Reichsanstalt, Sitzungs Verhandl.*, March 20, 1866) is correctly represented by the formula $NaO(U_2O_3)_2$. This formula is still employed, although it ought to have been changed to $Na_2U_2O_7$ when the formula for water was altered from HO to H_2O. The results of the experiments show that, although sodium uranate may actually be precipitated of the composition $Na_2U_2O_7$, on washing with water to remove the excess of alkali, it gradually undergoes partial hydrolysis, so that pure sodium uranate, obtained by adding sodium hydroxide to a solution of uranyl nitrate, has the composition $Na_4U_5O_{17}$, and Patera's precipitate the composition $Na_9U_{10}O_{35}$.

E. G.

[Preparation of] Uranates by a Wet Method. WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1909, 835—836).—A solution of calcium, strontium, barium, or magnesium chloride is added to a solution of uranyl chloride and the mixture treated with excess of ammonia (free from carbonate). The uranate is precipitated in the hydrated condition. The reaction is represented by the equation: $UO_2Cl_2 + MCl_2 + 4NH_3 + 2H_2O = MUO_4 + 4NH_4Cl$.

W. O. W.

Reduction of Titanium Chloride by Hydrogen. HANS GOERGES and ARTHUR STÄHLER (*Ber.*, 1909, 42, 3200—3218. Compare Abstr., 1905, ii, 40, 595).—The object of the present investigation was to determine the course of the reduction of anhydrous titanium tetrachloride by hydrogen, in order, if possible, to find the best methods of making the anhydrous trichloride and dichloride, and also the metal. It also presents other points of interest, in that titanium trichloride decomposes into the tetrachloride and dichloride at 440°, whereas in order to make it from the tetrachloride and hydrogen a temperature above 600° is necessary.

The anhydrous tetrachloride was prepared by chlorinating the carbide obtained from rutile, and was distilled in a special apparatus which contained no rubber connexions; the joints were all of glass, and any necessary seals were made with mercury, which is attacked to a very slight extent only by the tetrachloride.

In the first sets of experiments a dry mixture of titanium tetrachloride and hydrogen was passed through a porcelain tube, which was heated electrically to different definite temperatures. The amount of decomposition which took place was determined by measuring the amount of hydrogen and hydrogen chloride formed, and also the amount of tetrachloride remaining unchanged; the trichloride formed remained as a solid deposit in the porcelain tube. It was found that as the temperature rises, the amount of decomposition increases. At 785° the percentage decomposition was 21·7%, whereas at 1200° it was 94·3%. Experiments were made at eleven other temperatures lying between these two extremes. In all probability a state of equilibrium was reached while the gases were in the hot zone of the porcelain tube. When the concentration of the hydrogen is increased relatively to that of the titanium tetrachloride, the percentage decomposition increases. At constant temperature the ratio $[TiCl_3]^4/[TiCl_4]^3$ was approximately constant, but no explanation of this could be given. When hydrogen chloride was added to the mixture of titanium tetrachloride and hydrogen, the percentage decomposition was considerably diminished.

A new method is described, by means of which large quantities of anhydrous titanium trichloride can be prepared. The principle used is that of the hot-cold tube. A porcelain tube, which is electrically heated by means of a wire spiral inside it, is surrounded by a glass tube, which is externally cooled by a rapid stream of cold water. A mixture of titanium tetrachloride and hydrogen is passed through the space between these tubes, and the trichloride collects in large quantities on the surface of the cold tube as a fine, reddish-violet powder, which rapidly decomposes on exposure to moist air.

The anhydrous trichloride possesses an appreciable vapour tension of the tetrachloride, even at the ordinary temperature, so that it undergoes decomposition to some extent according to the equation: $2TiCl_3 \rightleftharpoons TiCl_2 + TiCl_4$. The dichloride was prepared from it according to the method of Friedel and Guérin (this Journ., 1876, i, 190), and was obtained as a black substance which dissolved in fuming hydrochloric acid with the formation of a green solution. This solution contained bivalent titanium, and gave the following reactions. On boiling in the air, it became violet, with the formation of tervalent titanium. Nitric acid oxidised it first to the tervalent condition (violet), and then to the quadrivalent (colourless). With titanium tetrachloride: violet colour, due to the formation of the trichloride. Ammonium hydroxide, carbonate, or sulphide gave first a dark brown precipitate, which decomposed after a short time with the rapid evolution of hydrogen. Potassium thiocyanate gave a green solution, and sodium acetate a green precipitate of the titanous acetate. On heating with mercuric chloride, calomel was precipitated.

Indications were obtained that when the trichloride is reduced by hydrogen at a bright red heat, some metallic titanium is formed.

T. S. P.

Colloidal Thorium. Edgar Wedekind and Heinrich Baumhauer (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 191—193).—This material is of special interest, as it is a radioactive element in a colloidal condition. The technique of its preparation was suggested by that of the authors' previous work with zirconium (compare Abstr., 1908, ii, 501). Finely-divided thorium metal (95—96%) is thoroughly rubbed up in a mortar with cold dilute acetic acid (a stronger acid would act on the metal). The paste is brought on to a filter, and the acetic acid washed out with cold water. At a certain point a colloidal solution passes through. It shows grey opalescence by reflected light, and appears brown when light is transmitted through it. The hydrosol of thorium is fairly stable in the presence of certain electrolytes, but alkalis readily bring about its precipitation, presumably because of the decomposition of thorium acetate, which exerts a protective action on the colloid. It is stable against mineral acids. Freezing invariably brings about coagulation, the precipitate being readily observable on thawing. A freshly dialysed colloidal thorium solution was examined in an electrolytic cell. It was free from electrolytes. The space round the anode rapidly became clear when a difference of potential of

18 volts was set up between the electrodes, the particles moving to the cathode. Colloidal thorium, therefore, like colloidal zirconium, carries a positive charge. In a very dilute solution, particles can be resolved ultramicroscopically. They appear colourless, smaller than those of zirconium, and to be in violent commotion. A comparison of the radio-activities of thorium as metal and as hydrosol showed that 0·0235 of the latter were equivalent to 0·111 of the former. It is remarkable and not explained that although metallic thorium has a radio-activity of 15·4 uranium-potassium-sulphate units, and that of thorium oxide prepared from it is 8·6, yet that of the thorium hydrosol is smaller than that of thorium nitrate solution. The gel dried in a high vacuum, and at a high temperature was found to contain thorium 20·5%, and thorium oxide 78%. G. S. W.

Equilibrium Reactions with Bismuth Hydroxide. Walter Herz and Alfred Bulla (*Zeitsch. anorg. Chem.*, 1909, **63**, 282—284).—The experiments of Herz and Muhs (Abstr., 1904, ii, 413) have been repeated, using the pure compound BiO·OH prepared by Moser's method (this vol., ii, 320). The two following reactions were studied:

$$BiO{\cdot}OH + KCl \rightleftarrows BiOCl + KOH$$
$$BiO{\cdot}OH + KBr \rightleftarrows BiOBr + KOH.$$

The values obtained for the equilibrium constants were 0·082 and 0·57 respectively, differing considerably from those formerly found from the reverse reactions. There are probably several distinct bismuth hydroxides. C. H. D.

Preparation of Colloidal Gold Solutions by means of Hydrogen Peroxide. Friedrich Doerinckel (*Zeitsch. anorg. Chem.*, 1909, **63**, 344—348).—A solution containing 6 grams $HAuCl_4,3H_2O$ per litre is used, 2 c.c. being added to 100 c.c. of water, followed by five drops of hydrogen peroxide solution, stirring continuously. Reduction sets in after a minute, and is complete in a few seconds, giving a deep wine-red solution with slight opalescence. Perfectly clear solutions may be prepared by the addition of Zsigmondy's "nucleus" solution to the above mixture.

In alkaline solutions, hydrogen peroxide gives only turbid suspensions, unless about 1 c.c. of the "nucleus" liquid is added, when a deep blue solution, clear in transmitted or reflected light, is obtained.

Several of the solutions have been compared ultra-microscopically with those prepared by reduction with phosphorus. C. H. D.

Gold-Magnesium Alloys. Rudolf Vogel (*Zeitsch. anorg. Chem.*, 1909, **63**, 169—183).—Alloys of gold and magnesium are best prepared by melting the magnesium in a current of hydrogen and adding the gold in small quantities, the reaction being violent. Alloys containing less than 27% Mg do not attack porcelain even at 1300°, but those richer in magnesium attack it, dissolving magnesium silicide.

Gold and magnesium form three compounds, each of which is indicated by a maximum on the freezing-point curve, AuMg melting at 1160°, $AuMg_2$ at 796°, and $AuMg_3$ at 830°. The first forms solid solutions with both components, and the last with small quantities of gold, but the latter solid solution breaks up into $AuMg_2$ and $AuMg_3$ at about 715°.

The alloys containing up to 18 atomic % Mg are yellow; all others are silver-grey. Those containing 30—66 atomic % Mg are brittle, with a maximum hardness 5 and glassy fracture; the other alloys are more or less malleable, with granular fracture. All are stable in air at the ordinary temperature, and only those containing free magnesium tarnish in moist air. With 66—75 atomic % Mg, swelling and disintegration takes place at 600°. From 0 to 50 atomic % Mg, only aqua regia attacks the alloys; from 50 to 60%, concentrated nitric acid; above this, dilute acids dissolve the magnesium.

Eutectic structures are well developed in the series. The compound $AuMg_3$ separates in large and regularly formed crystals from its alloys with magnesium. C. H. D.

Decomposition of Silver Tetrachloroplatinate by Water and the Preparation of Fulminating Platinum. JULES JACOBSEN (*Compt. rend.*, 1909, **149**, 574—577).—Silver tetrachloroplatinate is decomposed by water at 100° in three hours, or on the water-bath in eight hours, thus: $Ag_2PtCl_4(OH)_2 + H_2O \longrightarrow 2AgCl + H_2PtCl_2(OH)_4$. The silver chloride is contaminated with some platinum compound containing less chlorine than tetrachloroplatinate, but the yield of dichloroplatinic acid is 80—90% of the theoretical. The solution of dichloroplatinic acid containing only platinum and chlorine was decomposed by heating to 80—90°, and passing a slow stream of hydrogen sulphide for one hour, boiling, and treating with hydrogen sulphide for ten minutes. The platinum was entirely precipitated by this means, and the filtrate, having been boiled to remove hydrogen sulphide, was analysed for chlorine.

On pouring excess of ammonia into a solution of dichloroplatinic acid, the liquid turns a dark colour, and finally precipitates a brown, flocculent mass containing no chlorine and resembling ferric hydroxide. Washed with boiling water until free from ammonia and dried, this precipitate presents a conchoidal structure. If dried at 100° and then over sulphuric acid, it rehydrates with such avidity that the particles jump about. When it is heated gently above 250°, the compound blackens, and finally explodes with some violence, giving spongy platinum, nitrogen, oxygen, and water vapour. The fulminating compound, which is easily soluble in hydrochloric acid, contains 67·57% of platinum and 2·944% of ammonia. It loses water when heated, until at 220° 18·47% (6 molecules) have been removed. The formula $NH_3[Pt(OH)_5]_2$ corresponds with these properties.

If pyridine, instead of ammonia, is added to dichloroplatinic acid, an exactly similar detonating compound is obtained, to which the formula $C_5NH_5[Pt(OH)_5]_2$ is ascribed. The carbon and hydrogen contents are 8·893 and 2·188 respectively, instead of the calculated 9·397 and 2·349. R. J. C.

Decomposition of Ammonium Platinichloride and Ammonium Platinibromide by Heat. PRAFULLA CHANDRA RÂY and ATUL CHANDRA GHOSH (*Zeitsch. anorg. Chem.*, 1909, 64, 184—188).—Ammonium platinichloride decomposes when heated according to the equation: $3(NH_4)_2PtCl_6 = 3Pt + 16HCl + 2NH_4Cl + 2N_2$. The formation of di-imide (Maumené, Abstr., 1890, 262) does not take place. Collecting the ammonium chloride in a tube packed with asbestos, and the hydrogen chloride in a tube packed with glass beads moistened with potassium hydroxide solution, the ratio of the chlorine in the two tubes is found to vary, owing to the absorption of hydrogen chloride by the glass and asbestos. If the salt is very dry, traces of chlorine are set free.

Ammonium platinibromide decomposes partly in the same way: $3(NH_4)_2PtBr_6 = 3Pt + 16HBr + 2NH_4Br + 2N_2$, and partly with liberation of bromine: $(NH_4)_2PtBr_6 = Pt + 2NH_4Br + 4Br$. The quantity of bromine diminishes as the salt is more thoroughly dried.

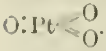
C. H. D.

Platinum Trioxide. A New Oxide of Platinum. LOTHAR WÖHLER and F. MARTIN (*Ber.*, 1909, 42, 3326—3333).—The hydrate of platinum dioxide was dissolved in 2*N*-potassium hydroxide, and the yellow solution submitted to anodic oxidation, being well cooled meanwhile. The anode was in the shape of a crucible, and the platinum wire cathode was contained in a porous cell filled with potassium hydroxide. Soon after the electrolysis was started, the anode became covered with a golden-coloured deposit, and this peeled off after a time in the form of thin plates, which had a silky sheen; this deposit was amorphous. After being well washed with ice-cold water, it was analysed and found to have the composition $3PtO_3,K_2O$, that is, it was an alkali salt of platinum trioxide. The trioxide itself was obtained from the salt by treatment with ice-cold *N*/2-acetic acid. A reddish-brown substance was obtained, which contained slightly less oxygen than that necessary for the trioxide, owing to the fact that it readily parts with some of its oxygen as soon as all the alkali has been removed. On keeping, the percentage of oxygen gradually decreases, but it never falls to that necessary for the dioxide, probably because a solid solution of the trioxide in the dioxide is formed.

Platinum trioxide is not acted on by dilute sulphuric, nitric, or acetic acids. It slowly liberates chlorine from dilute hydrochloric acid. Sulphurous acid dissolves it with the formation of a colourless complex. Concentrated sulphuric and nitric acids slowly decompose it with the formation of the dioxide. On gently heating, it gives the dioxide.

In the cold it has no action on alcohol or acetic acid. The oxidation which takes place on warming is due to the dioxide which is formed.

It does not decompose hydrogen peroxide, and must therefore be classed as a polyoxide or peroxide of platinum of the constitution



$O{:}Pt{<}^{O}_{O}$.

The formation of platinum trioxide explains a number of phenomena which have been observed by other investigators when working with platinum. In particular, it may be mentioned that the anodic passivity of platinum is probably due to the formation of this oxide.

T. S. P.

Platinum Selenides. ARNALDO MINOZZI (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 150—154).—The action of formaldehyde on a solution containing a platinichloride and a selenite in presence of excess of an alkali hydroxide yields *platinum triselenide* as a black, flocculent precipitate, thus: $K_2PtCl_6 + 3SeO_2 + 8H\cdot CHO + 12KOH = PtSe_3 + 6KCl + 8H\cdot CO_2K + 10H_2O$. When heated to dull redness in a current of carbon dioxide, the triselenide is converted into the *diselenide*, $PtSe_2$, which forms a greyish-black powder.

T. H. P.

Preparation and Composition of Double Compounds of $Pd(NH_3)_2X_2$ with $Pd(NH_3)_4X_2$. Preparation of $Pd(NH_2\cdot NH_2)Cl_2$. W. A. BURDAKOFF (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 757—759).—The *compound*, $Pd(NH_3)_2Br_2,4Pd(NH_3)_4Br_2$ or $PdBr_2,3\frac{3}{5}NH_3$, forms yellow crystals belonging to the quadratic system [I. TANATAR: axial ratio for the form {111}, 1 : 1·1487, and for the pyramid {112}, 1 : 0·5835]. On reduction with hydrogen, it decomposes according to the equation: $PdX_2,nNH_3 + H_2 = Pd + 2NH_4X + (n-2)NH_3$. This compound is analogous to the chloro-compound previously obtained (*ibid.*, 1897, 29, 739), which is now shown to have the formula $PdCl_2,3\frac{3}{5}NH_3$, and not $PdCl_2,3\frac{1}{3}NH_3$. The iodo-compound (compare *ibid.*, 1908, 40, 742) is not analogous with the chloro- and bromo-compounds, as it has the composition $PdI_2,3\frac{1}{3}NH_3,\frac{2}{3}H_2O$.

In the precipitation of palladium from solutions of palladium chloride by means of hydrazine hydrochloride, reduction to the metal takes place only in hot solutions. In the cold, the *compound*, $PdN_2H_4Cl_2$, separates as an abundant, yellowish-white precipitate; this compound is decomposed to some extent by water at the ordinary temperature, whilst on boiling with water, complete decomposition takes place according to the equation: $3PdN_2H_4Cl_2 = 3Pd + 2NH_4Cl + 4HCl + 2N_2$.

T. H. P.

Mineralogical Chemistry.

Optical Activity of Mineral Oils in an Optically Transparent State. Paraffin Content of Mineral Oils as Criterion for Judging their Relative Geological Age. LEO UBBELOHDE (*Ber.*, 1909, 42, 3242—3247).—Polemical. A criticism of Rakusin's views (compare this vol., ii, 490, 586).

W. H. G.

A New Occurrence of Lautite. LUCIEN DÜRR (*Mitt. Geol. Landesanst. Elsass-Lothringen*, 1907, 6, 249—252).—This mineral, previously known only from Marienberg, in Saxony, has been found as imperfect crystals and radial aggregates in association with native arsenic, tetrahedrite, smaltite, proustite, etc., at the Gabe Gottes mine in Rauenthal, near Markirch, Elsass. It is light steel-grey with a reddish-tinge; the streak is black. Brittle; H = 3—3½; D 4·53. There are good cleavages, and the mineral thus shows some resemblance to enargite. (Measurements of the angles between three co-zonal cleavages appear to indicate that the mineral is monoclinic.) Analysis agrees with the formula CuAsS.

Cu.	As.	S.	Total.
37·07	44·53	18·30	99·90

V. Dürrfeld (*op. cit.*, 1909, 7, 121—126) describes a single crystal of lautite from this locality; it is orthorhombic, with $a:b:c = 0·69124:1:1·0452$, and a perfect basal cleavage. L. J. S.

The Occurrence of Ammonia and Nitrates in Potash Deposits. Wilhelm Biltz (*Zeitsch. anorg. Chem.*, 1909, 64, 215—216. Compare this vol., ii, 571).—A specimen of salt-clay from Schönebeck showed an average ammonia content near that of samples from Stassfurt and Vienenburg, but a regular increase from the surfaces to the middle of the deposit could not be observed.

The value 0·2 mg. per litre for the ammonia in sea-water is too high; the value in the oceans more nearly approaches 0·05 mg.

C. H. D.

Pyromorphite from British Columbia. O. Bowles (*Amer. J. Sci.*, 1909, [iv], 28, 41—44).—Crystals of pyromorphite are found, together with cerussite and galena, in the Society Girl mine in south-eastern British Columbia. A crystallographic description is given of this material, and analysis (I) of wax-yellow crystals and (II) of green crystals. These analyses agree with the usually accepted formula, $Pb_5Cl(PO_4)_3$.

	PbO.	CaO.	FeO.	P_2O_5.	As_2O_5.	Cl.	CaF_2.	Insol.	Total, less O for F.	Sp. gr.
I.	80·20	0·59	0·86	16·12	0·41	2·52	trace	0·08	100·21	7·013
II.	80·13	0·56	0·46	15·65	0·90	2·59	—	0·05	99·75	7·051

L. J. S.

Vashegyite, a New Basic Aluminium Phosphate from Hungary. Karl Zimányi (*Math. és Természettud. Értesitö, Budapest*, 1909, 27, 64; *Zeitsch. Kryst. Min.*, 1909, 47, 53—55).—The mineral occurs in some abundance in limonite in the iron mine of Vashegy in comitat Gömör, where it forms compact, dull, white masses, with the appearance of meerschaum. It is porous, and adheres to the tongue. Hardness 2—3; D 1·964. Analysis I agrees with the formula $4Al_2O_3,3P_2O_5,30H_2O$:

	Al_2O_3.	Fe_2O_3.	K_2O.	Na_2O.	P_2O_5.	CO_2.	H_2O.	Insol.	Total.
I.	28·33	1·19	0·16	0·05	31·32	0·12	38·97	0·21	100·38
II.	29·44		—	—	27·28	—	29·15	14·62	100·49

With this new mineral are associated diadochite and a loose, crumbling mineral; the latter gave analysis II, corresponding with $3Al_2O_3(Fe_2O_3),2P_2O_5,17H_2O$. Other aluminium phosphates from this locality are evansite and variscite. L. J. S.

The Keilhauite-Zirkelite Group, and a New Mineral of that Group. Otto Hauser (*Zeitsch. anorg. Chem.*, 1909, 63, 340—343).—A new mineral, *uhligite*, regarded at first as perowskite, has been found in a strongly altered nepheline rock from East Africa.

The analysis shows:

Cb_2O_5.	TiO_2.	ZrO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Total.
Trace	48·25	21·95	10·50	trace	19·00	99·70

The mineral forms black, glistening octahedra, with conchoidal fracture; H 5—6. Its formula may be written

$$Ca(Zr,Ti)O_5,Al(Ti,Al)O_5;$$

it is thus an aluminous zirkelite, in which titanium predominates over zirconium.

Keilhauite is regarded as being derived from the monoclinic form of sphene by isomorphous replacement of Ti and Ca by Al, Y, Fe, etc., whilst zirkelite and uhligite are derived from the regular form of the same mineral. C. H. D.

Pyrogenetic Epidote. B. S. Butler (*Amer. J. Sci.*, 1909, [iv], 28, 27—32).—A review is given of the previous descriptions of presumably primary epidote in igneous rocks; in these instances the epidote is often intergrown with allanite in granite. Porphyritic crystals of epidote (anal. I, D = 3·29) are sparingly scattered through the porphyry (anal. II) of dykes cutting an extensive mass of soda-granite in Shasta Co., California. These crystals have a maximum length of 12 mm., and, like the porphyritic crystals of quartz, have been corroded by the magma. In addition to this porphyritic epidote, which appears to be a primary constituent of the rock, there is also some secondary epidote, present as minute granules, which has been derived from the biotite and felspar.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O at 105°.	H_2O above 105°.	Total.
I.	38·22	0·33	25·12	8·75	1·25	0·19	trace	22·77	0·11	0·06	0·52	3·04	100·36
II.*	68·75	0·27	16·75	0·48	1·72	0·04	0·83	0·89	6·95	0·80	0·84	1·52	100·06
III.†	80·09	0·16	10·80	1·07	0·83	0·02	0·58	0·38	5·60	nil	0·24	0·52	100·34

* Also P_2O_5, 0·16; BaO, 0·03; SrO, 0·03.

† Also ZrO_2, 0·01; P_2O_5, 0·04; BaO, SrO, nil.

L. J. S.

Nephrite and Magnesium Rocks from South Island, New Zealand. Alexander Moncrieff Finlayson (*Quart. Journ. Geol. Soc.*, 1909, 65, 351—380).—A description is given of the intrusive peridotites which extend as a belt along the western side of South Island. Analyses are given of the following minerals. Tourmaline (anal. I), occurring as large, dark green to black crystals with corundum and magnetite in a matrix of chlorite and serpentine at the contact of serpentine with schists at Parapara. Epidote (anal. II), pale yellow to colourless, columnar crystals, forming with some serpentine an epidote-rock at the contact of serpentine and limestone near Dun Mountain. Amphibole (anal. III), forming a serpentine-amphibole rock at the same contact as No. II. Nephrite (jade or New Zealand "greenstone"); analyses of a series of specimens selected to show the difference in composition (especially as regards the amount of iron) with the range in colour: IV, deep green; V, medium green; VI, olive-green; VII, pale green; VIII, greenish-white. The small amounts of alkalis shown in these analyses are no doubt due to the intermixture of glaucophane and riebeckite with the tremolite-actinolite molecules. When found *in situ*, the nephrite is associated with the peridotite and serpentine rocks. It may have had more than one mode of origin: (1) uralisation of the pyroxenes of the peridotites; (2) metamorphic action at the contact of serpentine and limestone; (3) direct change of olivine to nephrite; (4) deep-seated metamorphism of serpentine-talc-carbonate rocks. These changes were accompanied by great earth pressures and shearing, to which the compact and matted fibrous structure of the nephrite is ascribed.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
I.*	36·80	25·37	0·13	6·12	—	2·31	12·91	1·20	0·45	3·95	99·65
II.	42·45	23·27	7·91	1·22	—	21·52	1·45	—	—	2·62	100·44
III.	48·20	1·35	4·67	10·96	—	12·62	19·58	—	0·66	1·43	99·47
IV.	56·25	0·42	1·67	5·61	0·33	12·67	20·55	0·35	—	1·89	99·74
V.	56·01	0·65	1·88	5·02	0·29	13·41	20·65	0·45	0·28	2·03	100·67
VI.	55·89	2·34	2·39	2·34	0·41	13·97	18·72	0·51	—	2·21	98·78
VII.	57·45	1·09	0·24	1·35	0·28	15·41	20·61	—	0·51	2·65	99·59
VIII.	58·28	0·88	0·29	0·35	trace	14·98	22·08	0·42	0·38	1·98	99·64

* Also B_2O_3, 10·41; and traces of lithia and fluorine.

L. J. S.

Presence of Selenium in Mineral Waters from La Roche Posay. FELIX TABOURY (*Bull. Soc. chim.*, 1909, [iv], 5, 865—867).—The composition of the soluble matter contained in the waters from the three springs at La Roche-Posay is given. They each contain traces of lithium and 0·2% of selenium, both these constituents being found in that portion of the residue soluble in a mixture of alcohol and water. Arsenic, which has been recorded previously as occurring in these waters, could not be detected, and it is suggested that selenium may have been mistaken for arsenic. T. A. H.

Physiological Chemistry.

The Gaseous Exchange in Insects, and its Relation to the Temperature of the Air. B. SLOWTZOFF (*Biochem. Zeitsch.*, 1909, 19, 497—503).—The experiments were carried out chiefly with dung-beetles. The carbon dioxide output increases with rise of temperature to a certain maximum, at which it remains constant on a further rise over an interval of about 12°. The point at which this occurs varies with different insects. The respiratory quotients for different species of insects were determined. S. B. S.

The Light Extinction, the Capacity to Unite with Gases, and the Percentage of Iron in Human Blood-pigment in Normal and Pathological Conditions. E. E. BUTTERFIELD (*Zeitsch. physiol. Chem.*, 1909, **62**, 173—225).—In various diseased conditions, including the different kinds of anæmia, human hæmoglobin remains unchanged as regards the physical and chemical constants investigated. W. D. H.

Agglutination and Hæmolysis of Red Blood-corpuscles by Salts of Heavy Metals. J. DUNIN-BORKOWSKI and Z. SZYMANOWSKI (*Bull. Acad. Sci. Cracow*, 1909, 746—758).—There is no connexion between the agglutinating and hæmolysing power of the salts of the heavy metals and the valency and chemical relationship of these metals. G. B.

The Significance of the Cataphoresis of Blood-corpuscles. RUDOLF HÖBER (*Biochem. Zeitsch.*, 1909, **19**, 494—496).—Some theoretical remarks on the nature of the phenomena observed when blood-corpuscles are treated with carbon dioxide; a criticism of the views of Spiro and Henderson on this subject. S. B. S.

Total Sugar in the Plasma and Globules of Blood. RAPHAEL LÉPINE and R. BOULUD (*Compt. rend.*, 1909, **149**, 583—586. Compare Abstr., 1906, ii, 868; 1908, ii, 957; this vol., ii, 68).—Sugar in the blood estimated in the ordinary way is called by the author "immediate sugar," whilst the maximum amount of sugar obtained after treatment with hydrogen fluoride as already described is called "total sugar." An investigation is described on the estimation of sugar in the plasma and the corpuscles of blood from dogs in a normal condition and after deprivation from food. The sum of the immediate sugar of the plasma and clot is slightly higher than the immediate sugar of the blood before centrifugalisation; the total sugar, however, is the same in each case. W. O. W.

The Amount of Peptolytic Enzymes in Rabbit's Serum under Varying Conditions. II. EMIL ABDERHALDEN and WOLFGANG WEICHARDT (*Zeitsch. physiol. Chem.*, 1909, **62**, 120—128. Compare this vol., ii, 816).—In a previous research it was shown that normal rabbit's serum contains no peptolytic enzyme capable of decomposing glycyl-*l*-tyrosine into its constituents, but this enzyme appears when the rabbit has been intravenously treated with certain proteins —horse-serum and egg-white. In the present research, it is shown that the same result follows the intravenous administration of certain protein cleavage products, namely, certain peptones obtained by the partial acid hydrolysis of silk. W. D. H.

The Amount of Peptolytic Enzymes in Dog's Blood-serum under Various Conditions. III. Emil Abderhalden and Ludwig Pincussohn (*Zeitsch. physiol. Chem.*, 1909, 62, 243—249).—The peptolytic power of the normal blood-serum of the dog is nil, or almost so, but it appears on the parenteral administration of certain proteins and "peptones." This is not due to an enzyme specific in relation to the protein injected. It may be elicited by the subcutaneous injection of gliadin. This power of the serum is lost on heating to 60—65°.

W. D. H.

The So-called Artificial Complements. E. von Knaffl-Lenz (*Biochem. Zeitsch.*, 1909, 20, 1—9).—Comparisons were made between the action of artificial complements (oleic acid, etc.) and natural complements from serum, etc. It was found that hæmolysis caused by oleic acid, bile salts, or saponins could be inhibited equally strongly both by normal and immune sera. There was only a difference in the time of reaction. By heating the hæmolysing mixture to 56°, there was a very slight weakening of the hæmolysis in great dilutions, although the reaction time was lengthened. By heating highly diluted immune serum, it loses its activity. Blood-corpuscles, sensitised with a specific serum, are hæmolysed by soaps more quickly and as strongly as normal corpuscles. Mixtures of serum with solanin or sapotoxin act like the corresponding mixtures containing soaps; they differ in one respect only, in that hæmolysis undergoes neither weakening or slowing after heating to 56°. Oleic acid and bile salts behave differently to complements, with which they cannot, therefore, be regarded as identical.

S. B. S.

Metabolism of Different Classes of Animals. II. Emil Abderhalden and Carl Brahm (*Zeitsch. physiol. Chem.*, 1909, 62, 133—135).—Young dogs who have taken nothing but milk resemble rabbits in excreting pyridine as such. After they are fed on meat, they acquire the power of excreting pyridine as a methyl compound, but later in life even prolonged feeding on milk does not alter the metabolic habit when it is once developed. Rabbits, on the other hand, never form methylpyridine, even when fed on milk or on meat.

W. D. H.

The Digestion of Fat in the Animal Body. S. J. Levites (*Biochem. Zeitsch.*, 1909, 20, 220—223).—Only very slight saponification of beef-fat occurs in the stomach, although very marked liberation of fatty acids from the fat in yolk of egg may be observed. These experiments bring into harmony the apparently contradictory results of Volhard (compare Abstr., 1903, ii, 494) and Levites (compare Abstr., 1908, ii, 960).

G. S. W.

The Accelerating Effect of Potassium on Sugar Degradation. Alimentary Glycosuria. Julius Stoklasa (*Zeitsch. physiol. Chem.*, 1909, 62, 47—57).—Attention is called to certain experiments of the author which show that in plants the oxidation processes, as determined by the quantity of expired carbon dioxide, are more energetic in the presence of larger quantities of potassium than in the presence of small quantities or absence of this element. It is claimed that potassium plays an equally important part in the oxidation of sugar in the animal organism, and it is surmised by the author that the substance secreted by the pancreas which influences sugar metabolism contains potassium. S. B. S.

Can the Dog Digest Cellulose or Raw Fibre? Arthur Scheunert and Ernst Lötsch (*Biochem. Zeitsch.*, 1909, 20, 10—21).—The authors consider that the dog is incapable of digesting either cellulose or raw fibre, and that the previous statements to the contrary effect are due to faulty technique. Previous workers have failed to take account of the water and ash in the cellulose used for feeding, and the method of analysis (that of Simon-Lohrisch) gives false results, in that hydrogen peroxide, which is added to decolorise the mixture of alkali and substance under analysis, readily destroys the fibre. The authors recommend a method of analysis in which the organic matter other than the cellulose is destroyed by alkali (100 parts of hydroxide to 100 parts of water), and no peroxide is employed. S. B. S.

Influence of Silver Hydrosols and Salts on Nitrogen Metabolism. Guido Izar (*Biochem. Zeitsch.*, 1909, 20, 266—291).—Female dogs were injected by the jugular vein. The diet was constant, and systematic examination of urine and fæces was made. Solutions of silver, whether in the form of nitrate, thiosulphate, albuminate, or as hydrosol, rendered stable by the addition of a dilute dialysed gelatin solution, raise the amounts of "total nitrogen" and of "purine-nitrogen" excreted in the urine. The nitrogen excreted in the fæces is diminished by stable silver hydrosol, but to obtain the same result with nitrate, thiosulphate, or albuminate much larger doses are needed. This influence on the nitrogen metabolism could not be obtained by the injection of quite considerable quantities of "collargol" or of colloidal silver that had not been rendered stable.

G. S. W.

Protein Metabolism. Emil Abderhalden and E. S. London (*Zeitsch. physiol. Chem.*, 1909, 62, 237—242).—It seems to be accepted that an animal can construct its own protein out of proteins administered parentally. This has been accounted for by supposing that the injected protein is first excreted into the intestine, and thus undergoes digestion. The examination of the intestinal contents in a fistula dog after the subcutaneous administration of 200 grams of caseinogen dissolved in dilute sodium hydrogen carbonate solution, lend no support whatever to this hypothesis. A far more probable explanation is that the peptolytic and other ferments of the blood and other tissues perform the act of cleavage. W. D. H.

Peptic Digestion of Casein from the Standpoint of the Acidity of its Cleavage Products. Siegmund Küttner (*Pflüger's Archiv*, 1909, 129, 557—602).—By peptic digestion, casein is first decomposed into a phosphorus-free and a phosphorus-rich constituent.

The latter, paranuclein, on further digestion yields about equal parts of a phosphorus-free and a phosphorus-rich cleavage product. The former resists further gastric digestion and corresponds with Kühne's anti-complex; the latter yields peptides, and acid compounds which contain phosphorus (paranucleic acids); their presence increases the acidity of the digest. W. D. H.

The Cleavage of Histidine in the Dog's Organism Emil Abderhalden and Hans Einbeck (*Zeitsch. physiol. Chem.*, 1909, 62, 322—332).—The importance of histidine arises from the fact that it is an abundant cleavage product of globin, and so when red corpuscles are destroyed it may be important from the metabolic point of view. In the present research it was prepared from horse's red corpuscles. Its constitution suggests that it may play a part in purine metabolism, and Wiechowski's recent work shows that a necesary part of any such study is an estimation of allantoin in the urine. Examination of the fæces shows that histidine is well absorbed; when added to the diet, urea and ammonia increase in the urine, and this is followed later by a small rise in purine bases and uric acid. Using the best methods for the estimation of allantoin, the amount is increased on the days histidine is given, but the effect is certainly very small. W. D. H.

The Metabolic Changes of Nucleic Acid in the Organism of the Dog under Normal and Pathological Conditions. Alfred Schittenhelm (*Zeitsch. physiol. Chem.*, 1909, 62, 80—99).—The sodium salt of α-thymonucleic acid was employed in the experiments. The total nitrogen, uric acid, purine bases, and allantoin were estimated in the urine, and the total and basic nitrogen in the fæces. If the nucleic acid is added to the normal diet of a dog, it undergoes the same changes as the endogenous nitrogen. The increased nucleic acid is excreted chiefly in the form of allantoin. Before ingestion of the additional nucleic acid, 96·8% of the purine derivatives were excreted as allantoin; after ingestion the amount was 95%. The injection of nucleic acid does not lead to the same result. Similar results were obtained when nucleic acid was administered to a starving animal. In the case of animals receiving large quantities of alcohol, the excretion was somewhat delayed. S. B. S.

Fate of the Non-hydroxylated Benzene Ring of Protein in the Animal Body. Phenaceturic Acid as an Important Constituent of Urine. Haralamb Vasiliu (*Bied. Zentr.*, 1909, 38, 644—645; from *Mitt. landw. Inst. Univ. Breslau*, 1909, 4, 703. Compare this vol., ii, 250).—Further experiments showed that the non-hydroxylated benzene ring is mostly destroyed by a carnivorous animal, but not by a non-carnivorous animal, about two-fifths being recovered in the form of hippuric acid and three-fifths is phenaceturic acid. Consequently, the protein (containing 4—5% of non-hydroxylated benzene) is less completely utilised by non-carnivorous than by carnivorous animals.

The destruction of the benzene ring depends, not on the animal, but on the nature of the food, and most probably on the reaction by which the combustion of the food in the cells proceeds. N. H. J. M.

The Comparative Physiology of Hunger Metabolism. V. B. Slowtzoff (*Biochem. Zeitsch.*, 1909, 19, 504—508).—The starvation metabolism of dung-beetles (*Geotrupes stercoralis*) was investigated. The insects in question die of starvation in five to eleven days, losing 21·73% of their original weight. This loss is due chiefly to water and fat. The energy utilised was calculated at 39·41 Cal. per kilo. per twenty-four hours. The amount of proteins utilised during starvation was only about one-fifth of the original quantity. The amounts of pentose and of chitin in the bodies did not change during starvation. S. B. S.

The Glycolytic Enzymes of the Pancreas. Julius Stoklasa (*Zeitsch. physiol. Chem.*, 1909, 62, 36—46).—The enzyme preparation was made by precipitating the expressed juice of the pancreas by alcohol-ether mixture, and rapidly drying the precipitate. The product thus obtained was found capable of producing carbon dioxide, lactic acid, and alcohol from sucrose, lactose, and maltose. Very appreciable quantities were produced within eight hours; the presence of antiseptics considerably slowed the reaction. From the monosaccharides, on the other hand, only minute quantities of carbon dioxide were obtainable under the same conditions and in the same interval of time. Monosaccharides, however, evolved considerable quantities of the gas after forty-eight hours. The latter action is due to bacteria.

S. B. S.

The Question of Pancreas Lactase (Investigations on Human New-born Children and Sucklings). J. Ibrahim and L. Kaumheimer (*Zeitsch. physiol. Chem.*, 1909, 62, 287—295).—The pancreas, either of new-born children or of those in the suckling period, contains no lactase. W. D. H.

The Occurrence of Peptolytic Enzymes in Invertebrates. Emil Abderhalden and Robert Heise (*Zeitsch. physiol. Chem.*, 1909, 62, 136—138).—Extracts of the alimentary canal of nearly all the invertebrates examined (including coelenterates, echinoderms, worms, arthropods, and molluscs) liberate tyrosine from glycyl-*l*-tyrosine.

W. D. H.

Action of Arsenic on Autolysis. Guido Izar (*Biochem. Zeitsch.*, 1909, 21, 46—50).—The way in which arsenic affects autolysis depends on the quantity. Small amounts inhibit, larger amounts accelerate it.

W. D. H.

Action of Silver Salts on the Autolysis of Liver. Guido Izar (*Biochem. Zeitsch.*, 1909, 20, 249—265).—The accelerating action of silver hydrosols on liver autolysis led to this investigation. A number of salts and soluble compounds of silver were tested in this respect, and, in addition, their influence on the capacities of liver-extract to degrade and build up uric acid was examined. With the exception of collargol and protargol, for small concentration of the silver salt the increase of non-precipitable nitrogen in liver autolysis accompanies the increase of silver salt. This process soon reaches a maximum, which differs for different salts, and larger doses inhibit the action. The yields of purine bases and monoamino-acids vary concordantly with the "total-autolysis" as measured by the method employed. With regard to the albumoses, the reverse would appear to be the case. The formation of uric acid is favoured by silver sulphate, acetate, nitrate, or citrate, and it is the more so with increasing amounts. The decomposition is favoured by small doses of the same salts, but is hindered by larger doses. Traces of potassium cyanide, nitric acid, and carbon monoxide have no influence on liver-autolysis that has been stimulated by silver nitrate. G. S. W.

Production of Sugar in the Perfused Liver of Diabetic Animals. Leone Lattes (*Biochem. Zeitsch.*, 1909, 20, 215—219. Compare Abstr., 1904, ii, 829).—The formation of sugar by artificially-perfused glycogen-free livers of dogs was not markedly raised by the extirpation of the pancreas or poisoning by phloridzin some days before killing. On the other hand, the formation of acetoacetic acid is, under these conditions, increased. G. S. W.

Lactic Acid Formation in the Body. I. Rudolf Türkel (*Biochem. Zeitsch.*, 1909, 20, 431).—During the aseptic autolysis of liver, formation of lactic acid is followed by its rapid destruction, and after some days, it disappears from the mixture. A sugar- and glycogen-free liver does not produce appreciably less autolytic lactic acid than one having normal carbohydrate content. Added inositol does not increase the lactic acid formation. Following the addition of dextrose and alanine, an increased acid production was in some cases observed, but in other cases a negative result was obtained. The combined researches of workers on this subject indicate that there is a cell-constituent of unknown nature which gives rise to the lactic acid produced during liver autolysis. G. S. W.

Decomposition of β-Hydroxybutyric Acid and Acetoacetic Acid by Enzymes of the Liver. Alfred J. Wakeman and Henry D. Dakin (*J. Biol. Chem.*, 1909, 6, 373—390).—The liver cells, or aqueous extracts of the liver, contain an enzyme (*β-hydroxybutyrase*) which converts β-hydroxybutyric acid into acetoacetic acid. Its action is increased by the addition of blood or of crystallised oxyhæmoglobin, which furnish the necessary oxygen readily. Serum causes some acceleration, but the addition of other tissues causes inconstant results. The liver tissue also decomposes acetoacetates, but here the addition of blood produces no increase in the action.

W. D. H.

Lecithin and Jecorin in the Liver of Normal Dogs and those Poisoned with Alcohol. A. Baskoff (*Zeitsch. physiol. Chem.*, 1909, 62, 162—172).—Alcohol poisoning has a destructive influence on the lecithin, but not on the jecorin of the liver. The latter remains unaltered in amount and composition. W. D. H.

Uric Acid Formation. II. Regeneration of Destroyed Uric Acid in the Artificially-perfused Liver. C. Bezzola, Guido Izar, and Luigi Preti. **III. Uric Acid Formation in Liver Extracts after the Addition of Dialuric Acid and Urea.** Marcel Ascoli and Guido Izar. **IV.** Luigi Preti (*Zeitsch. physiol. Chem.*, 1909, **62**, 229—236, 347—353, 354—357).—II. By perfusing the dog's liver with arterialised blood containing uric acid, a marked decrease of the uric acid occurs in the perfusing fluid; but by perfusing the same with blood saturated with carbon dioxide, the uric acid which had disappeared appears again.

III. A large number of the decomposition products in various combinations was added to finely minced liver, and usually no formation of uric acid occurred; the only positive result was obtained by the addition of dialuric acid and urea.

IV. The restoration of uric acid noted in II. above is due to the action of an enzyme which occurs in blood and blood-serum, but not in the blood-free liver. W. D. H.

The Action of Calcium and Strontium Salts on the Heart and Blood-vascular System. K. Rutkewitsch (*Pflüger's Archiv*, 1909, **129**, 487—505).—Weak solutions of calcium and strontium salts increase the excitability and contractility of the cardiac muscle. Stronger solutions increase the contractility, but lessen the excitability. The rise of blood-pressure in the case of calcium salts is due mainly to the action on the heart; in the case of strontium, principally to an action on the vessels. The brachycardia sometimes seen is secondarily produced by stimulation of the vagus centre by the high blood-pressure. W. D. H.

Influence of Calcium on the Pupil. John Auer and Samuel J. Meltzer (*Amer. J. Physiol.*, 1905, **25**, 43—65).—Intravenous injection of an $m/8$-calcium chloride solution causes in rabbits a maximal contraction of the pupils, and the iris loses its excitability. The muscle mainly, and the motor nerve-endings probably, are affected; the sympathetic nerve fibres are also less excitable. The pupil slowly recovers after many hours. Atropine only slightly antagonises the effect; adrenaline and cocaine are rather more powerful antagonists. The action of adrenaline is more marked after removal of the superior cervical ganglion. Ether and asphyxia (to a less extent) retard the development of the myosis and hasten its disappearance.
W. D. H.

Internal Secretion of Chromaffine Tissue. Rud. Ehrmann (*Pflüger's Archiv*, 1909, **129**, 402—406).—Polemical. The chief question discussed is one of priority, namely, whether Meltzer or the author first described the action of adrenaline on the pupil.
W. D. H.

The Lipoids of the Lung. Nadine Sieber. **The Composition of the Lung.** Nadine Sieber and W. Dzierzgowski. **The Purines of the Lung.** Nadine Sieber and W. Dzierzgowski. **The Enzymes of the Lung.** Nadine Sieber and W. Dzierzgowski (*Zeitsch. physiol. Chem.*, 1909, **62**, 250—253, 254—258, 259—262, 263—270).—The first paper relates to the preparation of lecithin and jecorin from lung tissue; the proportion between the two phosphatides was 6:1. A crystalline material, identified as *iso*cholesterol, was also obtained. The second paper gives analytical details of water, solids, ash, phosphorus, sulphur, iron, nitrogen, fat, etc., in the lungs.

The percentage of the purine bases comes out differently according to the method employed; xanthine, however, was always the least abundant.

The horse's lung contains a catalase, a peroxydase, a glucase, and a diastase. W. D. H.

Formation of Dextrorotatory Lactic Acid during the Autolysis of Animal Organs. IV. Takeo Saito and Junji Yoshikawa (*Zeitsch. physiol. Chem.*, 1909, 62, 107—112).—In previous work it has been shown that on the autolysis of spleen, testis, and flesh, *d*-lactic acid appears, and this is to some extent destroyed on further action. In the present research, the appearance of the acid during autolysis of the thymus is described, but it is at present uncertain whether any disappears later, or whether such disappearance is of enzymic origin. The same is true for the lungs, but fresh lung contains a small amount of the acid before autolysis sets in. W. D. H.

Extractives of Fish Muscle. Umetaro Suzuki and K. Yoshimura [with M. Yamakawa and Y. Irie] (*Zeitsch. physiol. Chem.*, 1909, 62, 1—35; *J. Coll. Agr. Tōkyō*, 1909, 1, 21—58).—The aqueous extracts of the muscle of the lobster and of a number of fishes, including the salmon and the fresh-water eel, have been examined. In Japan, fish is an important article of diet, and a knowledge of the extractives may throw some light on cases of poisoning which not infrequently occur. Fish-extract appears to differ from meat-extract in containing appreciable quantities of monoamino-acids; in addition, carnosine, histidine, arginine, and lysine may occur in relatively large amounts. It is thought that eventually almost all protein fission-products will thus be met with, and that they are not simply waste products, but are used in metabolism. In one dried variety of fish ("Tka") a large quantity of a base was found, probably δ-aminovaleric acid, previously isolated by Salkowski from putrid pancreas G. B.

The Cutaneous Fats. P. G. Unna and L. Golodetz (*Biochem. Zeitsch.*, 1909, 20, 469—502).—Fats from the sebaceous glands, the fat of perspiration, the horny layer, etc., were investigated, and the content in cholesterol, oxycholesterol, *iso*cholesterol, and cholesterol esters determined. The three former substances were estimated in small quantities of fat by means of a spectrophotometrical method, using the acetic anhydride-sulphuric acid reaction, in which each substance gives characteristic bands. The amount of esters was ascertained by determining the increase in the amount of cholesterol caused by hydrolysis of the fat. It was found that both the intra- and extra-cellular fats of the skin are free from *iso*cholesterol, and in this respect differ from wool-fat (lanolin). The cutaneous fats contain, however, cholesterol esters. There are various quantitative differences between the skin-fats of various origin, which are specified by the author. S. B. S.

The Occurrence of Silicic Acid in the Organism. Carl Cerný (*Zeitsch. physiol. Chem.*, 1909, 62, 296—314).—The substance described by Drechsel as an orthosilicic acid ester in birds' feathers is a mixture of fatty acid esters of a high molecular alcohol, possibly of several such alcohols. It probably originates in the glands in connexion with the feathers. The occurrence of silicic acid in it is probably accidental; the amount found is never more than a trace, and it is often absent. W. D. H.

The Significance of the Tissue as a Chlorine Depôt. Valdemar Wahlgren (*Arch. exp. Path. Pharm.*, 1909, 61, 97—112).—The chlorine and water were estimated in the organs both of normal animals and of animals which had been injected with hypertonic sodium salt solutions, and were killed while the organisms still retained some of the excess chlorine. It was found that in normal animals the skin, blood, kidneys, and lungs contain the largest percentage amount of chlorine, and the muscles the smallest. The average percentage for the whole body was 0·17%. A third of the total exists in the skin. After intravenous injection, the largest increased percentage is found in the lungs, then in the intestine, blood, skin, and kidneys. The largest absolute increase is found in the muscles, intestine, and skin. After intravenous injection of hypertonic sodium chloride solutions, the water requisite for blood dilution comes chiefly from the muscles. The water content of the connective tissue also increases. S. B. S.

Distribution of Iodine [in the Body]. R. von den Velden (*Biochem. Zeitsch.*, 1909, 21, 123—130).—Drugs act endogenously by uniting with chemical groups in tissue protoplasm, or exogenously. Iodine appears to have affinities for many tissues, and this varies in disease as compared with health. According to Loeb, iodine which is not neurotropic becomes united with lipoid and fatty groups in the nervous system, and this view is confirmed by experiments on rabbits with iodival (iodo*iso*valerylcarbamide), given either by the mouth or subcutaneously. The amount of iodine which acts endogenously is small; the percentage of the element in the brain, for instance, is low, or it may be absent; nevertheless, it is slightly neurotropic and lipotropic; but in man this action appears to be negligible, and the excretion of iodine is rapid. W. D. H.

Preformed Hypoxanthine. V. N. Leonard and Walter Jones (*J. Biol. Chem.*, 1909, 6, 453—460).—It seems to have been established that muscular exercise contributes to uric acid formation, and the most important purine base which contributes to the endogenous uric acid is muscular preformed hypoxanthine; this is not directly connected with nuclein metabolism, since it may occur in the absence of adenase, an essential factor in the passage from nucleic acid to hypoxanthine. W. D. H.

The Action of Cells of Different Organs on Bacterial Extracts. H. Toyosumi (*Biochem. Zeitsch.*, 1909, 20, 39—55).—The cells of the organs of a normal guinea-pig possess the capacity of making the extract of cholera vibrios inactive, in that the same lose their precipitability and power of acting as complement. The organs of guinea-pig act more strongly in this respect than those of rabbits. The action of leucocytes and liver cells is stronger than the cells of other organs. S. B. S.

The Permeability of Cells for Dyes. Rudolf Höber (*Biochem. Zeitsch.*, 1909, 20, 56—99).—Ruhland has called attention to the fact that certain aniline dyes do not behave in accordance with Overton's theory that dyes which stain cells on *intra vitam* application are soluble in lipoids, whereas those which behave differently in this respect do not. Thus, methylene-green, malachite-green, thionin, and others are soluble only with difficulty in lipoids, yet they stain spirogyra, whereas cyanosin, erythrosin, Bengal-pink, and others are soluble in lipoids, and will not stain this organism. Other contradictions to the Overton theory were discovered in experiments on the intestinal epithelium of frogs and the blood-corpuscles of the fish-salamander. The author calls attention to the fact that the exceptions to the Overton theory are not as numerous as would appear from Ruhland's work. Thus, no single case is known with certainty where a lipoid-soluble basic dye fails to stain *intra vitam*, and only one case in which a sulphonic acid dye, which is lipoid-soluble, does not colour. The acid dyes, which are exceptions to the Overton theory, are hardly ever sulphonic acids. More in accordance with facts, however, than the Overton theory is the statement that basic dyes act as *intra vitam* stains, whereas the acid dyes, as a rule, do not. The kidney epithelium does, however, possess the capacity to take up acid dyes, and this property depends on the colloidity of the dye. Thus, a non-colloidal or slightly colloidal dye is readily taken up, as is also a hydrophil colloid (a property determined experimentally by precipitability by zinc or calcium chloride). If a dye, on the other hand, is not readily taken up by the kidney cells, it is of suspension-colloidal nature. The liver of a frog does not possess the capacity of eliminating highly colloidal dyes. Indigo-carmine is the only dye eliminated with certainty in the bile-passages. S. B. S.

Does a Change of Fat into Glycogen Occur in the Silkworm during Metamorphosis? Y. Kotake and Y. Sera (*Zeitsch. physiol. Chem.*, 1909, 62, 115—117).—During the chrysalis stage, the amount of glycogen in the pupa is markedly lessened, and there is no ground for Couvreur's statement (*Compt. rend. Soc. biol.*, 1895, 796) that fat is transformed into glycogen. W. D. H.

An Enzyme in the Silkworm which produces Ammonia as a Cleavage Product of Amino-compounds. T. Takeuchi and R. Inouye (*J. Coll. Agr. Tokyō*, 1909, 1, 15—20).—The larva, pupa, and moth of the silkworm (*Bombyx mori*) contain an enzyme which readily liberates ammonia from asparagine, but only to a slight extent from other amino-compounds (urea, biuret). G. B.

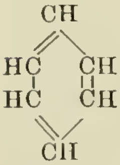
The Situation of Kynurenic Acid Formation in the Dog's Organism. EMIL ABDERHALDEN, E. S. LONDON, and LUDWIG PINCUSSOHN (*Zeitsch. physiol. Chem.*, 1909, **62**, 139—141).—The administration of tryptophan, the parent substance of kynurenic acid, produces an increased excretion of that acid, not only in normal dogs, but also in those with an Eck's fistula. The liver is therefore certainly not the only place where kynurenic acid is formed from tryptophan.
W. D. H.

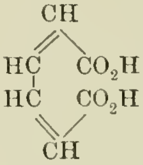
The Condition of the Calcium in Milk. I. PETER RONA and LEONOR MICHAELIS (*Biochem. Zeitsch.*, 1909, **21**, 114—122).—In order to determine the proportion of calcium in milk which is in solution, as opposed to that in a colloidal state, the method of dialysis was employed. Milk was dialysed against rennet-whey, and also against the filtrate after precipitation of the protein by colloidal iron hydroxide; in the case of rennet-whey, the calcium in it rises, whilst that in iron-whey falls. From such experiments it is found that from 40 to 50% of the total calcium is diffusible. The percentage of calcium in "iron-whey" is higher than in rennet-whey, and this is diffusible; the treatment with colloidal iron peroxide, therefore, converts a part of the indiffusible into diffusible calcium. This was confirmed by electrical conductivity and cryoscopic methods. Sterilisation produces no change. The amount of phosphoric acid in iron-whey is small, and reasons are given in support of the view that a good deal of calcium is united to protein. The addition of pure caseinogen to milk de-ionises the calcium present, and prevents the subsequent action of rennet.
W. D. H.

The Ingestion and Excretion of Radium Emanations by the Human Organism. F. L. KOHLRAUSCH and ERICH PLATE (*Biochem. Zeitsch.*, 1909, **20**, 22—38).—The measurements were made by means of a Schmidt electrometer, of which the authors give a complete description. The urine was examined for radium emanations after drinking or bathing in emanation-containing water, generally after an interval of half an hour. No emanation could be detected after drinking water containing 100,000 units, nor after bathing in water containing 700,000 units, whether the patient was free to breathe the air of the bath-room or not; in the latter case a special form of helmet was worn. S. B. S.

Physiology of Glands. XIII. Excretion of Total Nitrogen and Uric Acid during feeding with Proteoses. LEON ASHER and KARL REICHENAU (*Biochem. Zeitsch.*, 1909, **21**, 76—102. Compare Abstr., 1909, ii, 1503).—Feeding on milk somatose has little or no influence on uric acid excretion. Tannin in small doses increases it, and this may be due to increased formation or diminished destruction. If a large dose (50 grams) of somatose is added to a nitrogen-rich diet, the effect is in no way different as regards total nitrogen and uric acid from that produced by any other protein. W. D. H.

The Scission of the Benzene Ring in the Organism. I. The Appearance of Muconic Acid in the Urine after Doses of Benzene. Max Jaffé (*Zeitsch. physiol. Chem.*, 1909, 62, 59—67).—The residue, after distilling off the alcohol, of an alcoholic extract of evaporated urine of animals which had received large quantities of benzene was dissolved in water. The aqueous solution was extracted with ether. The ethereal solution deposited, on concentration, first gummy matter; the filtrate from this, on further concentration, deposited crystals, which were shown to be muconic acid, m. p. 289—290° (decomp.). Further crops of crystals were obtained on concentrating the filtrates. It was identified by the preparation of the methyl ester, m. p. 151—152°, and the tetrabromo-additive product, which darkened on heating at 230° and charred at 250°. The yield, calculated on the ingested benzene, was only 0·3%. Dogs and rabbits were the animals used for experiment, and the muconic acid was obtained also after ingestion of pure benzene prepared from benzoic acid. Its relationship to benzene is indicated in the annexed formulæ. This acid is the first direct scission product of benzene isolated in the urine. S. B. S.





Formation of Tribenzamide by the Action of Benzoyl Chloride on Urine. Alexander Ellinger and Otto Riesser (*Zeitsch. physiol. Chem.*, 1909, 62, 271—275).—The product described by Garrod and Hurtley (Abstr., 1906, ii, 471) as a benzoyl derivative of tryptophan, probably benzoylkynurine, is shown to be tribenzamide (Curtius, Abstr., 1901, 58). Kynurine cannot be benzoylated by means of benzoyl chloride. J. J. S.

Carbohydrates in Pathological Fluids and the Question of Residual Nitrogen. Otto Sittig (*Biochem. Zeitsch*, 1909, 21, 14—34).—Twenty-three specimens of various pathological body-fluids were examined, and in six of these the carbohydrate percentage was high. Pentose was never found, the usual sugar is dextrose; lævulose was found in a few cases. Lævorotation was sometimes observed in fluids freed from both proteins and carbohydrates; this is attributed to amino-acids, and in one case tyrosine was isolated. Transudations are rich in sugar; exudations (that is inflammatory fluids) are poor in, or free from, sugar. W. D. H.

Alcaptonuria. Oskar Adler (*Biochem. Zeitsch.*, 1909, 21, 5—13).—No support was found for the hypothesis that another alcapton acid occurs in the urine in addition to quinolacetic acid. The existence of the so-called uroleucic acid is problematical. Administration of sodium iodide leads to no rise in nitrogen excreted, or to an alteration in the homogentisic acid : N ratio. On the following days, however, there is a slight increase in the homogentisic acid. The uric acid excretion and purine metabolism appear to be unchanged, but in alcaptonuria the administration of ammonium chloride leads to the appearance of much free ammonia. W. D. H.

The Peptolytic Enzymes in Different Forms of Cancer and other Tumours. II. EMIL ABDERHALDEN, A. H. KOELKER, and FLORENTIN MEDIGRECEANU (*Zeitsch. physiol. Chem.*, 1909, **62**, 145—161). Compare this vol., ii, 688).—This is a portion of a large projected investigation on the enzymes of tumour cells, the object being to determine what differences are to be found between these and those obtained from the expressed juices of normal tissues. The present paper relates to peptolytic enzymes, and the tumours investigated were mainly those obtained from inoculated mice. No qualitative differences were found between the tumour extracts and those of normal tissues, but the former appear to be more energetic in their action.

W. D. H.

The Occurrence of Different Urinary Sugars and their Origin from Different Organs. FREDERIC LANDOLF (*Biochem. Zeitsch.*, 1909, **21**, 108—109).—A few cases of different kinds of diabetes are briefly described; the nature of the osazones differs, and in cases of pancreatic origin numerous osazones are sometimes obtained. The conclusion drawn is that the nature of the carbohydrate differs according to the organ or organs, which atrophy and degenerate in the body.

W. D. H.

Is the Difference in the Behaviour of Lævulose and Dextrose as Glycogen Formers in Diabetes Characteristic only for this Condition? E. NEUBAUER (*Arch. exp. Path. Pharm*, 1909, **61**, 174—185).—It has been shown that administration of phosphorus causes disappearance of glycogen from the liver. Sugars were given to starving animals which had been poisoned by phosphorus. It was found that the absence of glycogen in phosphorus poisoning is due to the diminished ability to fix this carbohydrate; this happens, however, only in the case of dextrose, just as in the case of pancreatic diabetes; if lævulose or sucrose is employed as the carbohydrate, glycogen will be found in the liver. This ability to fix glycogen from these carbohydrates is also, as in the case of diabetes, only transient. The peculiar action in the formation of glycogen from lævulose, as opposed to dextrose, is not therefore characteristic of diabetes.

S. B. S.

Adrenaline Diabetes. LEO POLLAK (*Arch. exp. Path. Pharm.*, 1909, **61**, 149—173).—I. *The differences in the behaviour of liver glycogen formed from dextrose and laevulose on treatment with adrenaline.*—Rabbits from the same litter were starved for four days, and then the same quantity of either dextrose or lævulose was administered by the stomach-tube. After sixteen hours, adrenaline was administered, and, eight hours later, the animals were killed and the glycogen in the liver was estimated. It was found that the resistance of the glycogen in the adrenaline action, whether formed from dextrose or lævulose, was the same when large doses of the drug were employed. If small doses, however, be employed, the lævulose glycogen was more resistant.

II. *Adrenaline glycosuria.*—Intravenous injection of adrenaline causes hyperglycæmia, which is not sufficient to cause glycosuria unless increased diuresis is brought about simultaneously. A single subcutaneous adrenaline injection can, however, cause both hyperglycæmia and glycosuria, and the former symptom is more pronounced than in the case of intravenous injection, and sufficient to produce the latter symptom without increasing the diuresis. Repeated subcutaneous injections produce hyperglycæmia without glycosuria, and it is assumed that chronic adrenaline employment must in some way influence the kidneys. To produce glycosuria, the sugar-content in the blood should exceed 0·25% in the case of rabbits.

III. *The formation in starving rabbits of glycogen produced under the influence of adrenaline action.*—Repeated administration of adrenaline in increasing doses to starving rabbits (even those in which the liver has been entirely deprived of glycogen by strychnine convulsions) causes glycogen formation in the liver, in quantities such as have been observed only after feeding with carbohydrates. S. B. S.

Gout. Solubility of Uric Acid and Sodium Urate in Serum. Influence of Inorganic Electrolytes on the Separation of Uric Acid and Urates from Serum. Influence of Radium Emanation. HEINRICH BECHHOLD and J. ZIEGLER (*Biochem. Zeitsch.*, 1909, 20, 189—214).—The authors investigated the conditions determining solution and precipitation of uric acid and sodium urate in blood-serum. If for one hour serum is kept in contact with uric acid at 37° and filtered, a filtrate is obtained in which no uric acid crystals can be discovered microscopically. If this filtrate is left for twenty-four hours at 37°, a thick layer is deposited. Further, such a serum as this can be treated again with uric acid in a similar manner so as to become "overfilled," and it will again deposit its excess of acid as before. No explanation of this phenomenon is forthcoming, and as the operations are carried out at constant temperature it cannot be considered to be one of supersaturation. The term "overfilling" (überfüllung) is applied to this operation for this reason, and it is suggested that an exact study of the medium will provide a solution of the problem. Microscopically examined the white, crystalline precipitate is in the form of fine needles, and in no way resembles ordinary uric acid. Recrystallisation from a little water yields the well known rhombic crystals, and an analysis shows that at most small quantities of alkaline urates are present. This is of special interest in its bearing on the multitudinous forms of slightly impure uric acid crystals observed microscopically. With respect to the phenomenon of overfilling with uric acid, fresh serum, and serum inactivated by heating at 58°, behave differently. Fresh serum precipitates the excess of uric acid again in twenty-four hours under all conditions. From inactivated serum, precipitation depends on certain obscure factors. Sometimes inactivated serum "overfilled" with uric acid, and contained in a flask full to the top so that there is no air-bubble between the paraffined cork and the serum, or in a flask in which the surface of the serum is covered by a layer of oil, will give no uric acid precipitate. If the flask is not quite filled and the surface of the serum does not come up to the neck, then the precipitation of the excess of uric acid will take place in twenty four hours, even if the surface is covered with oil. These phenomena are not observed for all sera, and the differences between them are not understood. Towards the explanation of the differences of behaviour of normal and inactivated serum, it is suggested that in the latter the higher hydroxyl ion content hinders the deposition of uric acid crystals. At 37° the solubility of uric acid in inactive ox-serum is found to be 1 : 1100 (overfilling) and 1 : 1925 (filling).

The solubility of monosodium urate in the same solvent and at the same temperature is 1 : 40,000. Monosodium urate is, therefore, less soluble in serum than uric acid, although it is more soluble than it is in water. Dilution with water and physiological saline inhibit the precipitation of these two substances from serum ; OH-ions (NaOH) and H-ions (HCl) act similarly. So also do the salts of potassium, lithium, and magnesium, although sodium and ammonium salts usually act in the other direction.

Figures given indicate that the blood of gouty patients is supersaturated with urates and readily deposits them. In the treatment of gout, lithium salts are advised, but the amount present in "lithia waters" is much too small. Drinking spa waters, especially those containing potassium and magnesium, should be beneficial ; waters containing sodium salts are not recommended. Similarly, a vegetable diet has, in spite of its potassium and magnesium salts and low purine content, the disadvantage that it gives rise to the elaboration of too much ammonium salts. Radium emanation interferes with the precipitation of uric acid from serum. Its influence on a solution of sodium urate cannot be definitely stated. G. S. W.

Thyroidectomy and Carbohydrate Metabolism. Frank P. Underhill and Warren W. Hilditch (*Amer. J. Physiol.*, 1909, 25, 66—76).—In dogs the presence of at least two parathyroids maintains life in a healthy state. Complete removal of all the parathyroids and the thyroid itself lowers the power of the body to assimilate dextrose, and increases the urinary ammonia. If one thyroid and three parathyroids are removed, the sugar-assimilative power of the body is measurably lessened. The administration of adrenaline chloride subcutaneously causes glycosuria in dogs deprived of both thyroids, but retaining at least two parathyroids. No symptoms of myxœdema are observed in full grown dogs after removal of the thyroids and partial parathyroidectomy. Massaglia's positive results were obtained with young dogs. W. D. H.

The Bleaching of Flour. William D. Halliburton (*J. Hygiene*, 1909, 9, 170—181).—The artificial bleaching of flour by nitrogen peroxide now so largely practised produces a diminution of its digestibility. Experiments *in vitro* show that minute amounts of nitrites retard the digestion of both starch and protein ; this is partly due to their action on the enzyme, and partly (in the case of gluten and other proteins) to their action on the protein. In bread made from the flour, the lessening of digestibility is not so marked, and the amount of nitrite-reacting material present is reduced to one-half of that in the flour itself. Although the action is not pronounced, care will have to be exercised to see that millers do not exceed the limits of safety. W. D. H.

The Resorption of Parenterally Administered Magnesium, and its Influence on Calcium Metabolism. Konrad Fromherz (*Arch. exp. Path. Pharm.*, 1909, 61, 210—230).—Investigations were undertaken in view of the various employments of magnesium in surgical practice. Estimations were made of the amounts of magnesium and calcium ingested and excreted in both urine and fæces, and the influence of metallic magnesium (injected or sewn under the skin) and of magnesium oxide on the calcium-magnesium balance was determined. The nutrition is, however, of great influence on the division of the alkaline earths and phosphates between urine and fæces. With animal food, which is poor in lime and rich in phosphorus, the output is equally divided, or the excretion by the kidneys predominates. With excess of lime, the excretion by the gut predominates. The phosphoric acid content of the food also influences the mode of excretion. In a diet rich in phosphoric acid and lime, it was found that the replacement of calcium by magnesium is more difficult than in a diet poor in these substances. No definite conclusions as to the influence of magnesium on calcium metabolism can, however, be drawn without at the same time investigating the intake and output of phosphoric acid. S. B. S.

Physiological Effect of Cobalt Carbonyl Vapour. Henry W. Armit (*J. Hygiene*, 1909, 9, 249—251).—From the negative experiments on animals described, the conclusion is drawn that owing to its low vapour tension and ready dissociability, cobalt carbonyl contrasted with nickel- or iron-carbonyl is unlikely to produce acute poisoning W. D. H.

Oxidation of Borneolglucoside in a Bio-chemical Manner. Hermann Hildebrandt (*Biochem. Zeitsch.*, 1909, 21, 1—4),—Borneolglucoside differs from many other glucosides (for instance, mentholglucoside) by its sparing solubility and in the difficulty with which borneol-glycuronic acid is prepared from it. If subcutaneously administered to rabbits, the urine contains a small amount of borneolglycuronic acid, indicating that the warm-blooded animals are able to oxidise a small quantity of the material. This is not the case at all in frogs. W. D. H.

The Behaviour of Betaine, Methylpyridinium Hydroxide, and Trigonelline in the Animal Organism. Arnt Kohlrausch (*Chem. Zentr.*, 1909, ii, 465; from *Zentr. Physiol.*, 1909, 23, 143—147).—Betaine, after ingestion by cats and dogs, could be partly recovered unchanged in the urine. It was isolated by extracting the urine with methyl alcohol after evaporation to a syrup; the crude product was purified by means of the mercuric chloride double salt. Besides betaine, a product was isolated, of which the hydrochloride was more readily soluble than that of betaine, and yielded an aurichloride which was apparently identical with that of trimethylamine. Methylpyridinium hydroxide is unchanged in the organism. Trigonelline is not changed into methylpyridinium hydroxide after subcutaneous administration to cats and rabbits. S. B. S.

The Biological Behaviour of Iodoproteins. HERMANN FREUND (*Biochem. Zeitsch.*, 1909, 20, 503—515).—The behaviour of iodoproteins as regards the formation of specific anti-substances was investigated, the biological reactions employed being the formation of precipitins, the deviation of the complements, and the production of anaphylaxis. It was found that immune sera which react strongly with normal proteins will not react with the corresponding iodoproteins. The anti-substances produced by injection of iodoproteins react with iodoproteins of different origins. Animals rendered over-sensitive to natural protein are not subject to anaphylactic shock on injection of the same protein after iodisation. The species specificity of a protein is considerably modified as regards its biological action by iodisation.. S. B. S.

Behaviour of Pyridine in the Hen's Organism. ZIN-NOSUKE HOSHIAI (*Zeitsch. physiol. Chem.*, 1909, 62, 118—119).—His and, later, Cohn stated that in the dog, pyridine unites with a methyl group from some unknown tissue constituent, and passes as methylpyridinium hydroxide into the urine. In rabbits, Abderhalden and his colleagues showed that this does not occur. The present experiments on the hen show that it acts like the dog. W. D. H.

Physiological Action of Tutin. FRANK FITCHETT and JOHN MALCOLM (*Quart. J. exp. Physiol.*, 1909, 2, 335—362).—The New Zealand tutu plant has been known to cause death in animals since the days of the early settlers. Tutin is a glucoside which is the active principle. The severity of its toxic effects in different classes of animals is proportional to the degree of differentiation of the nervous system, and the effects on the alimentary, respiratory, and other systems are the result of the excitation of nerve-cells. The heart is but little affected; the respiratory centre is strongly stimulated, and death is proceeded by convulsions and coma, due to exhaustion of the nervous system; the cerebral grey matter is markedly congested. Tutin is readily absorbed, and excreted with difficulty; it is not found in appreciable amount in gastric juice, urine, or milk; it has no effect on nutrition as a whole. No remedy has been found, but alkalis will destroy unabsorbed tutin in the stomach. No immunity after repeated dosage occurs. W. D. H.

The Mechanism of the Action of Arsenic Derivatives in Trypanosomiasis. G. LEVADITI (*Ann. Inst. Pasteur*, 1909, 23, 604—643).—It has been found that the toxic action of atoxyl on trypanosomes *in vitro* is but slight. A trypanotoxyl can, however, be prepared by treating atoxyl with the extract of liver or other organs. This trypanotoxyl, which readily acts on trypanosomes *in vitro*, appears to be a protein derivative, and is rendered innocuous by heating it at 100°. It can be precipitated by alcohol. If the trypanosomes be treated with trypanotoxyl, they readily take up arsenic. The arsenic can also be taken up by other cells when they are treated by trypanotoxyl; spermatozoa can in this way be rendered immobile. For this reason, although trypanotoxyl kills trypanosomes *in vitro*, it is not more effective than atoxyl when injected into an infected animal, unless it be mixed with the trypanosomes before injection. It is taken up by the cells of the body rather than by the parasites. The theory is advanced that the trypanotoxyl is prepared by the organs in the body and exerts its toxic action on trypanosomes *in stata nascendi*. The conception is also advanced that the protein in trypanotoxyl acts as an amboceptor, the arsenic acting as complement. S. B. S.

Mercury Poisoning with the Simultaneous Action of Hirudin. Marie Kohan (*Arch. expt. Path. Pharm.*, 1909, 61, 132—148).—It has been suggested that mercury poisoning is due to the production of thromboses. Investigations were carried out with the object of determining the truth of this hypothesis, hirudin being employed to prevent the normal clotting and to facilitate the detection of the thromboses in the post-mortem examinations. It was found that hirudin prevents the clotting of the blood, even in cases of mercury poisoning. In cases of acute mercury poisoning, the animals die and exhibit the same post-mortem symptoms whether hirudin be injected or not. The theory of thrombosis formation does not therefore appear to hold. The hirudin appears to accelerate the action of the mercury and to diminish the lethal dose. Rabbits were employed in the experiments. S. B. S.

Chemistry of Vegetable Physiology and Agriculture.

Simple Ventilating Tube for Fermentations. A. P. Bjerregaard (*J. Amer. Chem. Soc.*, 1909, 31, 1178).—A short piece of glass tubing constricted to a small opening at the lower end is packed fairly tightly with freshly ignited asbestos fibre, and inserted into the rubber stopper of the fermentation flask as soon as sterilisation is finished. This tube permits the escape of the gases produced during fermentation, but prevents the admission of foreign organisms.

E. G.

The Action of Salts on Bacteria. M. von Eisler (*Centr. Bakt. Par.*, 1909, i, 51, 546—564).—The organisms used were *Vibrio El Tor V* and *B. subtilis*. They were differently affected by the different salts. Thus *N*/10-lithium chloride inhibited development of *B. subtilis*, but even at double the concentration had no effect on the growth of the vibrio. The inhibiting effect of lithium chloride on *B. subtilis* can be overcome by adding certain quantities of bivalent, but not of univalent, salts. The inhibiting effect of a bivalent salt, for example, manganese chloride, can, however, be overcome either by addition of univalent or of bivalent salts. Nothing was found to overcome the poisoning effect of mercuric chloride.

Addition of salts to the nutrient agar on which vibrio was developing led to a change in form of the organism, so that it became an involute. The effect depends on the valency of the cation, bivalent salts being much more effective than univalent, whilst the anion seems only to play a subordinate part. Admixture with other salts gives the same results as before; the effect of a univalent salt is counteracted by addition of a bivalent, but not of another univalent, salt, whilst the potency of a bivalent salt is much reduced by addition of either a uni- or another bi-valent salt.

B. diphtheriae also assumes involution forms under the influence of neutral salts of the alkalis or alkaline earths, but larger quantities of salts are required. For this reason, addition of other salts has little or no effect in modifying the action. E. J. R.

Production of Indole by Bacteria. Selter (*Centr. Bakt. Par.*, 1909, i, 51, 465—476).—The author detects indole by means of Salkowsky's reagent (1 c.c. of 1 in 5000 sodium nitrite; 1 c.c. of 25% sulphuric acid added to 10 c.c. of the culture solution to be tested), and concludes that the test is still valuable for discriminating between typhus, paratyphus, and dysenteric organisms, on the one hand, and *Bacillus coli communis* and pseudodysenteric organisms, on the other, in spite of newer tests that have been suggested.

The most suitable culture medium for indole production is a 10% peptone solution containing also 0·5% sodium phosphate and 0·1% magnesium sulphate. Bouillon to which 5% of peptone has been added generally proves a good medium, but the ordinary 1% peptone is not suitable, on account of the sugar sometimes present. It is no advantage to use putrefying meat for the preparation of the bouillon.

Paratyphus (enteritis), true dysenteric, and certain pseudodysenteric organisms never gave positive results. The typhus bacillus formed small quantities of indole, which, however, could only be detected in the distillate from large quantities of the culture solution. Most of the pseudodysenteric organisms behaved irregularly, and from the same solution, and under the same conditions, would sometimes produce indole and sometimes not. *B. coli communis* gives a good reaction.

E. J. R.

Poisonous Action of Cobalt Salts on Aspergillus niger in Cultures on Solid and Liquid Media. M. L. Mortensen (*Centr. Bakt. Par.*, 1909, ii, 24, 521—538).—In 1% solutions of cobalt chloride the production of spores took place fifty-seven days after inoculation. Addition of gelatin (10%) reduced the time to twenty-two days, whilst with agar (2%) and gum arabic (10%) the time was twelve and eleven days respectively. In presence of kaolin (50%) and sand (50%), the number of days were fifteen and eleven, whilst powdered asbestos (25%) and kieselguhr (15%) both reduced the time to five days.

In solid media the silicates had a still greater effect in overcoming the poisonous action of cobalt. Powdered clay, kieselguhr, and talc had the greatest effect, and pumice stone, quartz sand, and kaolin the least.

Powdered glass had itself a poisonous action on *Aspergillus*. In solutions to which 40% of glass was added, the production of spores was delayed from two days (without glass and without cobalt chloride) to fifteen days. In presence of both glass and cobalt chloride (1%), the time was twelve days.

Precipitated calcium sulphate had only a slightly absorbing effect, whilst with gypsum plates there was a production of spores in eleven days in 3% solutions of cobalt chloride. N. H. J. M.

Chemistry of the Higher Fungi. IV. Maltases and Ferments which Decompose Glucosides. Julius Zellner (*Monatsh.*, 1909, 30, 655—662. Compare this vol., i, 543).—The sap of *Polyporus fomentarius* and *P. igniarius* have a vigorous hydrolysing action on maltose. Similar results were obtained with *Armilarius mellea*, *Hypholoma fasciculare*, *Daedalea quercina*, and *Trametes suaveolens*.

Aqueous extracts of *Trametes suaveolens* and *Polyporus igniarius* readily decompose salicin, amygdalin, coniferin, æsculin, and phloridzin. *Trametes* showed a selective action, salicin being much more readily decomposed than the other compounds. In the case of *Polyporus*, the powdered fungus was used, as the aqueous extract has little or no action, owing presumably to the insolubility of the enzyme.

Polyporus pinicola decomposes coniferin, amygdalin, salicin, and æsculin, but not phloridzin. N. H. J. M.

Polyporus rutilans. Max Bamberger and Anton Landsiedl (*Monatsh.*, 1909, 30, 673—674).—An acid having the properties of polyphoric acid was obtained from *Polyporus rutilans*, and several salts were prepared which were found to be similar to the derivatives obtained by Stahlschmidt (*Annalen*, 1877, 187, 177, and 195, 365). It is almost certain, therefore, that the fungus examined by Stahlschmidt was *Polyporus rutilans*, and not *P. igniarius*, as Klingemann suggested (Abstr., 1893, i, 602). N. H. J. M.

Differences of Susceptibility of Plants to Stimulation. T. Takeuchi (*J. Coll. Agric. Tōkyō*, 1909, 1, 207—210).—Different plants were grown in the same soil in pots, both without and with manganous sulphate ($MnSO_4,4H_2O = 0{\cdot}2$ gram in 8 kilos. of soil). The increase due to manganese was, for each plant, as follows: Barley, 5·3; flax, 13·9; pea, 19·4, and spinach, 41·0%.

N. H. J. M.

The Behaviour of Green Plants Towards Gaseous Formaldehyde. Viktor Grafe and Emmy Vieser (*Ber. Deut. bot. Ges.*, 1909, 27, 431—446).—The authors grow seedlings of *Phaseolus vulgaris* under bell jars and arrange three series of experiments: (1) with ordinary air; (2) with air free from carbon dioxide; (3) with air free from carbon dioxide, but carrying formaldehyde. Whilst the present paper is only regarded as preliminary, it is shown that plants can assimilate formaldehyde under the conditions of the experiment, and that they make a greater growth than in normal air. E. J. R.

Starch Formation from Adonitol in the Leaves of Adonis vernalis. O. Treboux (*Ber. Deut. bot. Ges.*, 1909, 27, 428—430).—Adonitol, the alcohol of the ribose synthetically prepared by Fischer, is the only pentitol known to occur in nature. It was first found in the leaves of *Adonis vernalis*, and is readily converted by them into starch.

The author picks leaves from the plant, keeps them in the dark long enough for all, or practically all, of the starch to disappear, and then floats them on a solution of adonitol. In a short time starch reappears in the leaf. No starch was formed when either galactose, milk sugar, mannitol, or dulcitol was substituted for adonitol; moreover, adonitol was more effective than the other sugars tried, for example, dextrose, lævulose, and sucrose. It appears that adonitol is the best source of starch for *Adonis vernalis*, but this rule does not hold for the other plants investigated. E. J. R.

Direct Assimilation of Ammonium Salts by Plants. Henry B. Hutchinson and Norman H. J. Miller (*J. Agric. Sci.*, 1909, 3, 179—194. Compare Müntz, Abstr., 1890, 79; Griffiths, *ibid.*, 1892, 229; Bréal, *ibid.*, 1893, ii, 590; Pitsch, *ibid.*, 1896, ii, 212; Mazé, *ibid.*, 1900, ii, 499; Kossowitsch, *ibid.*, 1902, ii, 684; Gerlach and Vogel, *ibid.*, 1905, ii, 346).—Three series of sand and water culture experiments are described, in which wheat and peas were grown under sterilised conditions with ammonium sulphate as source of nitrogen. The wheat plants in sand grew well when calcium carbonate was present, but were stunted in absence of carbonate. Sodium nitrate produced about the same amount as ammonium sulphate + calcium carbonate (sterilised), whilst ammonium sulphate inoculated with nitrifying organisms gave rather more dry matter. Wheat in water cultures gave similar results, although less dry matter was produced than in sand. The peas, which were grown in water cultures with calcium carbonate, showed no difference between the ammonium sulphate and the nitrate pots, all being equally healthy. The addition of dextrose to the ammonium sulphate pea cultures was without appreciable effect.

The results of all three series show that ammonium sulphate was directly assimilated, although in the case of wheat the plants showed a decided preference for nitrate. It is further shown that the plants which received ammonium sulphate contain a higher percentage of nitrogen than when supplied with nitrate. This accords with results furnished by the Rothamsted grass plots, the mixed herbage from the nitrate plot containing a lower percentage of nitrogen than that of the plots which have for a long time been manured with ammonium salts, and with results obtained by Pitsch and Mazé.

The seeds employed in the above experiments were sterilised by treating with warm mercuric chloride solution after removing any air bubbles with a vacuum pump. The apparatus employed for this purpose is described with sketch. The plants were grown in three-necked Woulffe's bottles, the middle neck being used for the plant, and the side necks for aeration and for adding water respectively.

N. H. J. M.

Phosphorus Metabolism in the Plant. W. Staniszkis (*Bull. Acad. Sci. Cracow*, 1909, 95—123).—The analyses extend over the whole vegetation period of millet. The seeds contain but little inorganic phosphorus; during development the phosphorus intake proceeds parallel with the increase in dry weight. Up to the formation of the panicles only small quantities of organic phosphorus compounds are formed, but afterwards, up to the ripening of the seeds, the amount of phosphoproteins and especially of phytin increases considerably; at the same time phosphorus passes from the stem to the leaves. The maximum lecithin content occurs in the early stages of formation of the panicles. While these are formed the protein-nitrogen decreases, although the total nitrogen increases; translocatory fission thus takes place. In ripe millet seeds, however, 97% of the nitrogen again occurs as protein. During the ripening of the seeds, the ratio protein-phosphorus : protein-nitrogen increases, showing that phosphorus-free proteins are being converted into phosphoproteins. G. B.

Erythrina. M. Betting (*Pharm. Weekblad*, 1909, 46, 1089—1092). —One hundred grams of the crushed leaves of a variety of *Erythrina* were placed in a generating flask, gently heated on a water-bath, and by means of an aspirator a current of purified air was drawn through the flask; 0·03% of nitrous anhydride was found to be given off, but this, of course, does not represent the true amount generated. Acetone was also found to be given off; the nature of the active principle of the leaves will be investigated. L. de K.

Development of Fat in the Black Walnut (Juglans nigra). F. M. M'Clenahan (*J. Amer. Chem. Soc.*, 1909, 31, 1093—1098).— Considerable uncertainty prevails with reference to the chemistry of the formation of fats in seeds. A study has therefore been made of the development of fat in the black walnut, and analyses have been made of the liquid kernel and of the solid kernel at various ages.

It has been found that the fat is not formed within the kernel from starch, sugar, or tannin, since these substances are absent from the interior of the kernel capsule at all stages of its development. The quantitative relations of the fats to the crude fibre, proteins, and pentosans indicate that the fats are not formed from the decomposition products of these substances. Magenta is not able to penetrate the interior of the kernel capsule, although it can penetrate the other parts of the nut, and it is therefore improbable that there is any direct circulatory connexion of the kernel with the outer parts. This is confirmed by the fact that, in the early stages, when the kernel is entirely liquid, there is a pronounced fluid pressure in the capsule. The walls of the capsule contain large quantities of tannin, and it seems possible that the fats may be formed from decomposition products of this substance, although these products do not reach the interior of the capsule by means of ordinary fluid circulation. The formation of the kernel commences by the deposition of a jelly-like substance on the interior surface of the capsule membrane. This gradually changes to a white solid, enclosing a further quantity of the jelly-like substance, which eventually is completely replaced by the solid kernel.

From a consideration of these facts, it is suggested that the inner-most cells of the capsule membrane cause the decomposition of the tannin and effect metamorphic syntheses, the newly-formed substances entering the interior of the capsule by osmosis. E. G.

Fat from the Seed of Erythrina hypaphorus subumbrans. N. H. COHEN (*Chem. Weekblad*, 1909, 6, 777—784).—By saponification with alcoholic potash and extraction with ether, the fat of the seed of *Erythrina hypaphorus subumbrans* has been separated into acids and an unsaponifiable portion. The acids are formic, oleic, linoleic, palmitic, and behenolic acids. The unsaponifiable part contains sitosterol and two other cholesterols, either identical with stigmasterol and brassicasterol or closely related to them.

A. J. W.

Hydrogen Cyanide in Cassava Flour. L. VUAFLART (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 27, 225—228).—The author has examined a sample of cassava flour intended for use as a food for animals, and found it to yield 0·0041% of hydrogen cyanide. Whilst this quantity is less than that which may be obtained from certain cyanogenetic seeds, haricot beans for instance, it should be remembered that haricot beans are generally cooked before use and most of the hydrogen cyanide is thus volatilised. Although no ill-effects resulted when pigs were fed on the cassava flour in question, it is considered advisable that farmers should obtain some information (by analysis) regarding the flour before using it as a fodder.

W. P. S.

Presence of Adenine in Bamboo Shoots. GINZABURO TOTANI (*Zeitsch. physiol. Chem.*, 1909, 62, 113—114. Compare Kozai, *Bull. Imperial College of Agriculture and Dendrology Komaba, Tōkyō*, 1890, 37).—The presence of adenine in the young shoots of bamboo has been established. J. J. S.

Urease in Higher Plants. T. TAKEUCHI (*J. Coll. Agr. Tōkyō*, 1909, 1, 1—14).—The seeds and seedlings of the soy-bean (*Glycine hispida*) contain an easily separable enzyme, which rapidly liberates ammonia from urea; it has a slight action on biuret, but not on other amino-compounds examined. G. B.

Photodynamic Action of Extracts of Etiolated Plants. WALTHER HAUSMANN and LEOPOLD VON PORTHEIM (*Biochem. Zeitsch.*, 1909, 21, 51—58).—Extracts in methyl alcohol of various etiolated plants invariably showed a distinct photodynamic action on suspensions of red-blood corpuscles. N. H. J. M.

Influence of Salts on the Poisonous Action of Quinine on Elodea canadensis. M. VON EISLER and LEOPOLD VON PORTHEIM (*Biochem. Zeitsch.*, 1909, 21, 59—75).—In presence of calcium, manganese, and aluminium salts, the poisonous action of quinine was considerably retarded, whilst potassium, sodium, and ammonium salts produced very little effect. Magnesium salts have a greater effect than potassium, but less than calcium salts.

Immersion of leaves for half an hour to an hour and a-half in solutions of calcium nitrate or manganese chloride was without effect on a subsequent treatment with quinine. N. H. J. M.

The Nature of the Acid Soluble Phosphorus Compounds of Some Important Feeding Materials. Edwin B. Hart and W. E. Tottingham (*J. Biol. Chem.*, 1909, 6, 431—444).—Phytin is present not only in wheat, but also in maize, oats, and barley; it could not be isolated from rutabagas or alfalfa hay. In wheat it is largely localised in the outer layer of the grain, but in the other grains it is uniformly distributed; in those seeds the phytin phosphorus amounts to 38—48% of the total phosphorus.

In rutabagas hay, 64% of the total phosphorus is inorganic, but there is also an unknown organic phosphorus compound present. In alfalfa hay, 65% of the phosphorus is inorganic; here also an organic phosphorus compound occurs. The reducing substance separated by dilute acid from alfalfa hay is possibly dextrose. No pentose was found. W. D. H.

Is Potassium Sulphate Physiologically Acid? Keijiro Asō (*J. Coll. Agric. Tōkyō*, 1909, 1, 223—225).—Oats were grown in sand manured with calcium hydrogen phosphate, ammonium nitrate, ferric hydroxide, and magnesium hydrogen phosphate. In addition the three sets of pots received respectively (1) potassium sulphate, (2) potassium hydrogen sulphate, and (3) potassium sulphate + potassium carbonate. There was no great difference in the yields in the three sets; in (3), however, in which the least root was produced, the yield of grain was distinctly higher than in the others.

A second experiment was made in which rice grown in sand received (in addition to calcium hydrogen phosphate, ammonium nitrate, magnesium hydrogen phosphate, potassium sulphate, and ferric chloride) (1) disodium hydrogen phosphate, (2) sodium dihydrogen phosphate, and (3) trisodium phosphate. The results showed a decided depression in the yield in presence of weak acid manure. The conclusion is drawn that the physiological acidity of potassium sulphate is much less marked than that of ammonium sulphate. N. H. J. M.

Is Artificial Calcium Carbonate more Effective than Limestone Meal? H. Yokoyama (*J. Coll. Agric. Tōkyō*, 1909, 1, 181—182).—Sand culture experiments with oats showed that precipitated calcium carbonate is not essentially more effective than limestone meal. In accordance with previous observations, it was found that the yield of oats decreased as soon as the amount of magnesia exceeded that of the lime. N. H. J. M.

Lime Factor for Oats. J. N. Sirker (*J. Coll. Agric. Tōkyō*, 1909, 1, 183—184).—The lime factor for oats in sand cultures was found to be 1, as shown by previous investigations. N. H. J. M.

Influence of Different Ratios of Lime to Magnesia on the Growth of Rice. Keijiro Aso (*J. Coll. Agric. Tōkyō*, 1909, 1, 171—173. Compare Abstr., 1904, ii, 765).—The former experiment, in which the manure employed was of an alkaline nature, was repeated with acid manure, phosphoric acid being applied as double superphosphate, potassium as sulphate, and nitrogen as ammonium sulphate and sodium nitrate. One series received calcium and magnesium as sulphates, the other as carbonates.

The results, like the earlier ones, show that any change in the ratio CaO : MgO = 1 tends to reduce the yield. N. H. J. M.

Proteins of Rice Seeds. UMETARO SUZUKI, K. YOSHIMURA, and S. FUJI (*J. Coll. Agric. Tōkyō*, 1909, 1, 77—88).—The dry matter of rice freed from husks was found to contain: total N, 1·200%, and N as proteins, 1·165%; the husks contained 2·958% and 2·665% respectively.

The various cleavage products were isolated and the amounts estimated. The following results in (1) rice freed from husks, and (2) the husks, are given: alanine (1), 3·7; leucine (1) 14·3, (2) 8·6; proline (1), 3·3; phenylalanine (1), 2·0; aspartic acid (1), 0·4; glutamic acid (1) 14·5, (2) 4·7; tyrosine (1) 0·5, (2) 0·3; lysine (1), 0·86; histidine (1) 0·81, (2) 0·88; arginine (1) 1·60, (2) 3·40; ammonia (1) 2·33, (2) 1·13% of the dry matter. N. H. J. M.

Effect of Chemical Manures on the Composition of Meadow Hay. P. CHAVAN (*Bied. Zentr.*, 1909, 38, 593—594; from *Ann. Agric. Suisse*, 1908; and *J. d'agric. prat.*, 1908, ii, 711).—Potassium salts alone considerably increased the yield of dry produce, and superphosphate alone produced a much greater increase than potassium salts alone. The two manures used together increased the yield in three years from 2878 to 12453 kilos. per hectare. Phosphatic manure distinctly increased the percentage of proteins.

As regards botanical composition, potassium manure increased the gramineous and leguminous herbage from 40·8 and 8·76 to 44·09 and 15·73% respectively. With phosphate, the amounts were 34·38 and 45·12, and with potassium salts and superphosphate, 42·12 and 46·73%.
N. H. J. M.

Yield of Leaves of Polygonum tinctorium with Abundant Nitrogenous Manure. T. TAKEUCHI (*J. Coll. Agric. Tōkyō*, 1909, 1, 189—191).—The plants were grown in plots of 12 square metres in a loamy humous soil. Application of sodium nitrate (300 and 360 grams) increased the yield of leaves by 16 and 41% respectively. Carbon disulphide (400 c.c.) gave an increase of 14%. N. H. J. M.

Application of Carbon Disulphide in Mulberry Culture. J. N. SIRKER (*J. Coll. Agric. Tōkyō*, 1909, 1, 185—187).—Application of carbon disulphide to the soil (450 c.c. to 16 square metres) increased the yield of mulberry leaves by 44%. N. H. J. M.

The Phosphoric Compounds in Wines. P. CARLES (*Bull. Soc. chim.*, 1909, [iv], 5, 962—969; *Bull. Assoc. chim. Sucr. Dist.*, 1909, 27, 217—223).—It is shown that most wines contain both mineral and organic phosphorus compounds, and that the organic phosphorus is most probably present as potassium or calcium glycerylphosphate, and not in the form of lecithin. In Gironde wines the organic phosphorus constitutes about one-tenth of the total amount of phosphorus present. Red wines were found to contain from 0·235 to 0·590 gram of phosphoric acid in mineral combination, and from 0·005 to 0·130 gram of phosphoric acid as glyceryl phosphates. In white wines these quantities vary from 0·190 to 0·600 and 0·0 to 0·050 gram per litre respectively. W. P. S.

The Chemical Composition of Tamari-Schoyu. K. Yoshimura (*J. Coll. Agric. Tōkyō*, 1909, 1, 89—96).—One litre of this beverage, obtained from soy beans, contains: putrescine 0·3 gram, ornithine 0·7 gram, ammonia 4·5 gram, and a base, $C_6H_9N_3$, 0·7 gram. The putrescine and ornithine are doubtless derived from arginine, of which the globulin of the soy beans contains about 5% (compare Osborne and Clapp, Abstr., 1907, i, 990). The histidine of this globulin is perhaps the parent substance of the base $C_6H_9N_3$. G. B.

The Carbohydrates of Shōyu. R. Mitsuda (*J. Coll. Agric. Tōkyō*, 1909, 1, 97—101).—There are present: glucose, a little galactose, traces of furfuraldehyde, and pentosans. G. B.

Action of Sulphurous Acid on Soils. Emil Haselhoff (*Exper. Stat. Record*, 1909, 21, 219—220; from *Internat. Phytopath. Dienst. Beigabe Zeits. Pflanzenkrank.*, 1908, 1, 73—91).—Pot experiments in which beans and barley were grown in presence of sulphurous acid (14·96 grams to 8 kilos. of soil) showed that the effect depends largely on the amount and character of the soil bases. In acid soils, growth was retarded, whilst in soils containing sufficient base to neutralise the sulphurous acid, no injurious effect was observed. N. H. J. M.

Catalase of Soils. David W. May and P. L. Gile (*Exper. Stat. Record*, 1909, 21, 220; from *Porto Rico Stat. Circ.* No. 9, 3—13. Compare König, Hasenbäumer, and Coppenrath, Abstr., 1906, ii, 303).—The rate of the reaction between soils and hydrogen peroxide depends on the amount of catalase present, on the amount and concentration of the peroxide, on the acidity or alkalinity of the solution, and on the amount of shaking. A method was adopted in which the number of minutes required by 5 grams of soil to liberate 100 c.c. of oxygen from 60 c.c. of neutral 0·92% hydrogen peroxide, was ascertained, the flask being shaken the whole time.

The catalytic action is materially inhibited by carbon disulphide; heating at a low temperature for a long time has more effect in destroying the catalase than higher temperatures for a short period. N. H. J. M.

Improvements in Sand Culture. T. Takeuchi (*J. Coll. Agric. Tōkyō*, 1909, 1, 197—202).—The following amounts of mineral and nitrogenous manures are recommended: K_2HPO_4, $KHPO_4$, K_2SO_4, NaCl (each 0·3 gram); NH_4NO_3, 1·2 gram (in two applications); $CaSO_4$, 0·6 gram; $Fe(OH)_3$, 0·8 gram; magnesite, 6·7 grams, and limestone, 5·3 grams in 4 kilos. of sand. Kaolin (5%) may be added with advantage when the question does not relate to potassium compounds; and the amount of limestone should be increased for plants other than *Gramineae* and flax. N. H. J. M.

Influence of the Ratio of Lime to Magnesia on the Yield in Sand Cultures. Keijiro Asō (*J. Coll. Agric. Tōkyō*, 1909, 1, 175—180. Compare Bernadini and Corso, this vol., ii, 606).—Results of sand culture experiments with different plants showed that the yields depend on ratio of lime to magnesia, whilst an absolute excess of either has no retarding effect when kept within certain limits. In experiments with oats manured with 2 grams of magnesia with 1, 2, 4, and 8 grams of lime, and with 10 grams of magnesia with 5, 10, 20, and 40 grams of lime, the highest yield was obtained in both cases when the ratio $CaO : MgO = 1 : 1$. N. H. J. M.

Manuring with Dicyanodiamide. Keijiro Asō (*J. Coll. Agric. Tōkyō*, 1909, 1, 211—222. Compare Abstr., 1906, ii, 890).—Water culture experiments with buckwheat showed that whilst 0·025% of dicyanodiamide killed the plants in about a month, 0·01% served as a nutrient. The same plants grown in soil (2 kilos.) containing 0·36 gram of dicyanodiamide were much injured. Oats in water cultures were not injured when the concentration was less than 0·025%.

Rice grown in paddy soil to which dicyanodiamide had been added three weeks before planting, produced nearly as much growth as with an equivalent amount of ammonium sulphate. N. H. J. M.

Manurial Experiments with Calcium Nitrate on Tobacco and Tomatoes. Albert Stutzer (*Bied. Zentr.*, 1909, 38, 638—639; from *Zeitsch. landw. Versuchswesen Oesterr.*, 1908, 531).—Calcium nitrate gave good results with tobacco. The experiments with tomatoes were inconclusive, owing to unfavourable weather.

N. H. J. M.

Preservation of Night-soil. Keijiro Asō and S. Nishimura (*J. Coll. Agric. Tōkyō*, 1909, 1, 145—151).—The following substances were employed as preservatives: (1) superphosphate, (2) gypsum, (3) monocalcium phosphate, (4) gypsum + monocalcium phosphate, and (5) kainite. It was found that gypsum and kainite had comparatively little effect. Monocalcium phosphate proved to be much the best preservative, and then superphosphate.

The amount of superphosphate employed was 0·5%, and the amounts of the other substances contained the same amount of sulphuric and phosphoric anhydrides respectively as were present in the superphosphate. N. H. J. M.

Application of Dicyanodiamide as a Nitrogenous Manure. R. Inouye (*J. Coll. Agric. Tōkyō*, 1909, 1, 193—196).—Rape and barley were grown in soil manured with the same amounts of nitrogen in the forms of ammonium sulphate and dicyanodiamide and in both forms together. The results showed that dicyanodiamide applied at the rate of 1 gram of nitrogen to 8 kilos. of soil is injurious, whilst 0·35 gram of nitrogen as dicyanodiamide and 0·7 gram as ammonium sulphate gave better results than when the whole amount was applied as ammonium sulphate. N. H. J. M.

Vegetation Experiments with Precipitated Calcium Phosphate. Henrik G. Söderbaum (*Bied. Zentr.*, 1909, 38, 585—587; from *Experimentalfaltet. Stockholm*, Nos. 95, 98, and 99, and *Zeitsch. landw. Versuchswesen Oesterr.*, 1908, 506).—Electrolytically precipitated calcium phosphate, having the composition of a diphosphate, was found to be equal to superphosphate, and its availability, unlike that of tricalcium phosphate, is not essentially diminished by the presence of considerable amounts of calcium carbonate. N. H. J. M.

Secondary Calcium Phosphate as a Manure. T. Takeuchi (*J. Coll. Agric. Tōkyō*, 1909, 1, 203—206).—Experiments on rice grown in sand showed that the absorption of phosphoric acid, as secondary calcium phosphate, is depressed by an excess of calcium and magnesium to such an extent as to prevent the formation of ears. By increasing the amount of secondary calcium phosphate, the favourable ratio of lime to magnesia was altered somewhat; the gain due to phosphoric acid, however, much more than compensated for any depression due to an excess of calcium, and by altering the ratio $CaO,MgO:P_2O_5$ from 1 : 1 : 1 to 1 : 1 : 5 the yield of grain was increased by 65%.

As regards superphosphate, it is probable that only very large amounts of carbonate, will diminish its availability.

Other results will no doubt be obtained when calcium, magnesium, and phosphorus are present in forms soluble in water, or when the former are in other forms than carbonates. N. H. J. M.

Different Forms of Phosphoric Acid in Organic Manures. S. Tsuda (*J. Coll. Agric. Tōkyō*, 1909, 1, 167—170).—The total phosphorus and the phosphorus soluble in ether and alcohol (lecithin), in 0·2% and in 5% hydrochloric acid, was determined in (1) soy bean cake, (2) rape cake, (3) red clover hay, (4) herring guano, (5) steamed bone dust, (6) cake from pupa of silkworms, and (7) crab shells. The amounts in percentages of dry matter are as follows:

	Total P_2O_5.	As lecithin.	Soluble in 0·2% HCl.		Soluble in 5% HCl.		As nuclein.
			Inorganic.	As phytin.	Inorganic.	Organic.	
1.	1·311	0·114	0·050	0·640	0·040	0·120	0·236
2.	2·251	0·091	0·050	0·873	0·099	0·931	0·204
3.	0·554	0·050	trace	0·300	0·070	0·084	0·050
4.	4·670	0·310	1·894	0·860	0·372	0·648	0·583
5.	25·060	0·023	5·534	trace	18·859	0·530	0·112
6.	1·350	0·043	1·039	,,	0·090	trace	0·169
7.	3·23	0·023	0·300	0·151	2·261	0·200	0·302

N. H. J. M.

Manurial Value of Various Organic Phosphorus Compounds. Keijiro Asō and Y. Yoshida (*J. Coll. Agric. Tōkyō*, 1909, 1, 153—161. Compare J. Stoklasa, Abstr., 1896, ii, 266).—The results of pot experiments in which barley was manured with phosphorus ($P_2O_5 = 0{\cdot}396$ gram in 2·5 kilos. of soil) in the form of sodium phosphate, lecithin, phytin, nuclein, and aluminium, iron, and tricalcium phosphates respectively, showed that lecithin is equal in value to tricalcium phosphate, whilst phytin and nuclein gave about the same amounts of dry produce as were obtained with aluminium phosphate.

The manurial effect of rice bran and rape cake is increased by extracting with ether, but their manurial value is lost by extracting with 0·2% hydrochloric acid, and the conclusion is drawn that most of the phosphorus present is in the form of phytin. N. H. J. M.

Availability of Phosphoric Acid in Various Forms in Herring Guano. R. Mitsuta (*J. Coll. Agric. Tōkyō*, 1909, 1, 163—165).—Pot experiments with barley grown in soil manured with herring guano, both in its original state and freed from its various phosphorus compounds. Extraction with ether and alcohol, which removed the oils and lecithin, reduced the yield of air-dried produce from 8·5 to 7 grams. Further, extraction with hot water, and with hot water followed by 0·2% hydrochloric acid, reduced the yield to 5 and 1·2 grams respectively. When the manure is so completely extracted that only nuclein remained, it has no immediate value as a source of phosphorus. N. H. J. M.

Analytical Chemistry.

Characterisation of Indicators. M. Handa (*Ber.*, 1909, 42, 3179—3182).—The concentration of hydrogen or hydroxyl ions at which an indicator shows a change in colour can be determined as follows: To 50 c.c. of freshly boiled water are added four drops of a $0{\cdot}2/N$-barium hydroxide solution, and then two drops of the indicator. At a definite moment, 1 c.c. of freshly distilled methyl formate is added, and the time measured that is necessary for the colour change in the indicator to take place. In the case of phenolphthalein, litmus, and *p*-nitrophenol, the necessary hydrogen-ion concentrations have been determined by another method by Fels (Abstr., 1904, ii, 320). If the logarithms of these concentrations are plotted as ordinates, and the times, measured as above, as abscissæ, the points so obtained lie on a straight line. If the times are then measured for any other indicators, the hydrogen-ion concentration necessary to bring about the colour change can be determined from the curve. In this way the following concentrations have been determined: With methyl-red the first change in the alkali colour takes place when the hydrogen-ion concentration is $10^{-6·65}$, the characteristic intermediate colour being produced when the concentration is $10^{-6·4}$. Cyanin becomes decolorised when the hydrogen-ion concentration is $10^{-6·3}$. Methyl-red is thus slightly less delicate than litmus, and cyanin a little less delicate than methyl-red.

Accurate results could not be obtained with tropæolin, since the time to be measured is so short. Qualitatively the results confirm those of Fels, that is, the hydrogen-ion concentration which brings about a colour change is in the neighbourhood of $10^{-11·2}$. T. S. P.

The Accuracy of Volhard's Method for the Estimation of Chlorine. VICTOR ROTHMUND and A. BURGSTALLER (*Zeitsch. anorg. Chem.*, 1909, 63, 330—336).—It is necessary to the accuracy of the estimation of chlorine by Volhard's method that the precipitated silver chloride should not react to an appreciable extent with the soluble thiocyanate during the duration of the experiment. This condition is not usually fulfilled. When the quantity of chlorine is very small (under 5 millimols.), the results are inaccurate. A considerable excess of silver nitrate is of advantage, and inaccurate results are always obtained if an excess of thiocyanate is added and titrated back with silver. The tedious removal of the silver chloride by filtration, which ensures exact results, may be avoided by coagulating the chloride so as to reduce its surface. This may be done by adding sufficient ether to form two layers, shaking until clear, and then adding the ferric alum solution and titrating with thiocyanate. The sharpness of the end-point is increased by the presence of ether. This method is accurate, even when a very dilute solution is being titrated.

C. H. D.

The Gravimetric Estimation of Free Iodine by the Action of Metallic Silver. FRANK A. GOOCH and CLAUDE C. PERKINS (*Zeitsch. anorg. Chem.*, 1909, 63, 318—324; *Amer. J. Sci.*, 1909, [iv], 28, 33—39).—Free iodine may be estimated by shaking with reduced silver, the increase of weight of the latter being determined. Silver prepared by the action of zinc on the chloride, nitrate, or iodide, or by the action of hydrogen on the sulphide or oxide, should be treated before use with potassium iodide to convert any retained silver salts into iodide. An error is produced by the action of air on the potassium iodide, and this is greatest when the action of the silver is slow, as when the electrolytically deposited metal is used. The best results are obtained by working with electrolytic silver in a neutral or sodium hydrogen carbonate solution in an atmosphere of hydrogen, fifteen to twenty-five minutes being required for 0·65 gram of iodine, and the error being ± 0·0004 gram. C. H. D.

New Method for the Estimation of Iodides and of Free Iodine. STEPHAN BUGARSZKY and BÉLA HORVATH (*Zeitsch. anorg. Chem.*, 1909, 63, 184—196).—Iodine and bromine react in the presence of water reversibly: $I_2 + 5Br_2 + 6H_2O \rightleftharpoons 2HIO_3 + 10HBr$. The reaction is sufficiently rapid at 100°, and in presence of a large excess of bromine is practically complete in the sense of the upper arrow.

The excess of bromine may be rapidly boiled off without appreciable error, owing to the slowness of the reverse reaction.

The slightly acid solution, containing not more than 0·010—0·012 gram iodine, is placed in a narrow-necked 100 c.c. flask, and 50 c.c. of nearly saturated bromine water added, filling up with water. The flask is immersed in boiling water for an hour. The contents are transferred to a 250 c.c. conical flask, and boiled very briskly for four to five minutes to expel all the bromine. After cooling, 1—2 grams of potassium iodide are added, and, after acidification, the iodine is slowly titrated with thiosulphate, the quantity of iodine found being divided by six.

Ordinary bromine may be used, the iodine content being corrected for by a blank experiment, or the bromine may be purified by the following process, which completely removes iodine. The bromine is successively shaken with 20% potassium bromide solution, water, and concentrated sulphuric acid, and finally distilled over a little barium oxide in an apparatus entirely composed of glass, with ground joints.

The presence of an excess of bromides, chlorides, ammonium salts, nitrates, or nitrites in the solution to be analysed is without influence on the accuracy of the estimation. If the solution is sufficiently acid, the titration may even be performed in presence of iron or manganese salts, if the first disappearance of the blue colour be accepted as the end point.

The iodine content of the water from various iodine springs has been estimated by this method. Sea-water from Quarnero (Abbazia) contains 0·000075 gram of iodine per litre, being about one-millionth of the chlorine concentration. C. H. D.

Apparatus for the Estimation of Fluorides in Foods. H. Rosset (*Ann. Chim. anal.*, 1909, 14, 365—366).—The apparatus, which is a modification of the one used by Blarez, consists essentially of a truncated leaden vessel, on to which is screwed a brass refrigerating vessel, through which cold water is circulating; this serves to press down a glass disk, and to prevent, by thorough cooling, an escape of hydrofluoric acid.

Into the leaden vessel is introduced the mixed barium fluoride and sulphate, obtained by adding to the solution some sodium sulphate and barium acetate, and also 5 to 10 c.c. of sulphuric acid. The vessel is then heated gently on a metallic plate for two hours. The effect of the etching on the glass disk is then noticed, and by a comparison with standards a fair idea may be got as to the amount of fluorine present. L. de K.

Apparatus for the Estimation of Sulphur in Iron and Steel. Georg Preuss (*Zeitsch. angew. Chem.*, 1909, 22, 2044—2045).—The flask (Fig. 1) is furnished with a side-tube for introducing the hydrochloric acid, and for the purpose of passing a current of carbon dioxide. By means of a ground-joint, the flask is attached to a condenser, inside which is the absorption vessel. The worm-tube serves to condense the acid vapours whilst the gases pass through the valve tube into the absorption vessel. At the upper end of the tube a valve is attached in order to prevent any regurgitation of the absorption liquid.

Ten grams of steel, or 5 grams of pig-iron, are placed in the flask, and the condenser is fitted on and sealed with water. After introducing into the absorption tube 40 c.c. of the usual cadmium solution, 75—150 c.c. of hydrochloric acid, D 1·12, are introduced, and the whole is heated until the iron has dissolved and the last traces of hydrogen sulphide are then removed by means of a current of carbon dioxide.

FIG. 1.

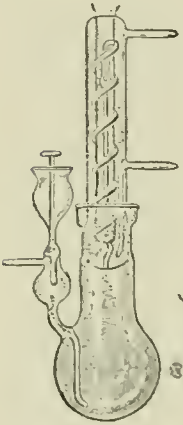
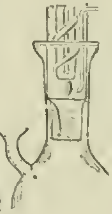


FIG. 2.



The condenser is then removed from the flask and the contents of the absorption vessel poured into a beaker; a few rinsings suffice to remove every trace of cadmium sulphide, which is then converted as usual into copper sulphide and weighed as such.

In the second form of apparatus (Fig 2) the gases evolved on heating with hydrochloric acid, D 1·19, are first passed through a little wash-bottle containing 50 c.c. of water so as to retain the greater part of the hydrochloric acid fumes. On removing the source of heat, this liquid runs back into the flask, whilst the recoil valve prevents a regurgitation of the cadmium solution.

L. DE K.

Detection of Sodium Sulphite in the Presence of Sodium Sulphate and Sodium Thiosulphate.

FRANK E. WESTON (*Chem. News*, 1909, 100, 176).—A 5% solution of the mixture is prepared, and to 5 c.c. of this a solution of *N*/10-iodine is added, if decolorised (sulphite or thiosulphate, or both) the addition is continued until a faint coloration sets in. The liquid is now tested as to acidity, and if acid, a sulphite is probably present. To another 5 c.c. of the solution is added half the volume of iodine solution used in the first test, and sulphur dioxide is then recognised by its odour and also by its power of reducing potassium dichromate; the sulphur dioxide points to the presence of a sulphite. If no green coloration is noticed, thiosulphate is present.

Sodium sulphate is tested for with barium chloride as usual.

L. DE K.

Quantitative Precipitation of Tellurium Dioxide, and its Application to the Separation of Tellurium from Selenium.

PHILIP E. BROWNING and WILLIAM R. FLINT (*Amer. J. Sci.*, 1909, [iv], 28, 112—118; *Zeitsch. anorg. Chem*, 1909, 64, 104—111).—The basic nitrate is dissolved in a little hydrochloric acid and then diluted largely with hot water. The solution is made alkaline with ammonia, and then again slightly acidified with acetic acid. The tellurium dioxide is collected on an asbestos filter, washed with cold water, and dried at 105°. The nitrate may be also dissolved in aqueous potassium hydroxide, and then acidified with hydrochloric acid, or the diluted solution may be simply acidified with acetic acid and then heated for some time to render tho precipitate crystalline.

Attempts to effect the separation of tellurium from copper and bismuth by means of potassium hydroxide were, however, not very successful, but for the separation of tellurium from selenium the process answers very well. L. de K.

Estimation of Nitrogen. Eilhard Alfred Mitscherlich (*Chem. Zeit.*, 1909, **33**, 1058).—A reply to Schenke (this vol., ii, 669). The author prefers his own process (this vol., ii, 614), and further states that for the estimation of nitrous nitrogen Schenke's process is quite unsuitable. L. de K.

Estimation of Ammonia in Ammonium Chloride. Oswald Claassen (*Chem. Zeit.*, 1909, **33**, 952).—A reversed condenser is inserted between the distilling flask and the Volhard's receiver in the distillation process. It is then unnecessary to cool the receiver, and there is no increase of volume of the contents. The same apparatus may be employed in the distillation of oxidising substances with hydrochloric acid. C. H. D.

Cuvette Arrangement for the Estimation of Nitrates by Schloesing's Process. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. Sucr. Dist.*, 1909, **27**, 83—84).—The capillary gas delivery tube plunges into a layer of mercury, about 1 cm. high, contained in a small basin made of porcelain or earthenware, or even of wood weighted with lead. The mercury prevents the absorption of water into the apparatus. L. de K.

Influence of Chlorides on the Estimation of Nitrates in Waters by Grandval and Lajoux's Process. Angel Sabatini (*Ann. Chim. anal.*, 1909, **14**, 366—367).—The author agrees with Perrier and Farcy (this vol., ii, 344) as to the influence of chlorides on the colorimetric determination of nitrates, and now proposes the following method: To 50—60 c.c. of the water to be tested are added 20 grams of silver oxide, and, after the lapse of two hours with occasional shaking, the liquid, now free from chlorides, is filtered and then examined colorimetrically for nitrates as usual. L. de K.

Estimation of Nitrite. A. Sanin (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 791—795).—The author's method for estimating nitrite is based on the change of acidity produced in a solution by the interaction of a nitrite with hydroxylamine hydrochloride:

$$NaNO_2 + NH_3O,HCl = NaCl + N_2O + 2H_2O.$$

The results are not affected by the presence of large or small proportions of nitrate. The solutions employed consist of $N/20$-sodium hydroxide and a solution of hydroxylamine hydrochloride (10 grams to 1 litre), the titre of which is measured against the sodium hydroxide solution, using phenolphthalein as indicator. The procedure is as follows:

Into a conical flask of capacity 150—200 c.c. are introduced 20 c.c.

of a solution of the nitrite containing 5 grams per litre and 20 c.c. of the hydroxylamine hydrochloride solution, the liquid being then heated for five to eight minutes on a gauze until bubbles of nitrous oxide are no longer evolved on shaking the flask; a temperature of 70—80° is sufficient for the completion of the reaction. After cooling, the solution is titrated with $N/20$-sodium hydroxide. The amount of nitrite is then calculated from the above equation. T. H. P.

Estimation of Phosphorus in Combustible Substances by the Bomb Calorimeter. Paul Lemoult (*Compt. rend.*, 1909, 149, 511—513. Compare Abstr., 1907, ii, 760).—Phosphorus and its gaseous compounds are burned without difficulty in the calorimetric bomb, using oxygen, and the phosphoric acids produced may be estimated as magnesium ammonium phosphate. Solid phosphorus compounds containing carbon give rise during combustion to some free phosphorus, which combines with the platinum capsule usually employed and escapes oxidation and estimation unless it is afterwards dissolved out by cold nitric acid.

Capsules of porcelain, glass, or quartz are invariably broken by the heat, allowing some of the substance to fall and escape combustion. If a porcelain capsule is supported in a platinum frame, there is no loss of material from this cause, but black stains containing unoxidised phosphorus always remain on the porcelain. Satisfactory analytical results are only obtained when a porcelain capsule in a platinum frame and coated with fused potassium nitrate is used. The phosphorus is completely converted into phosphoric acid, which is washed out of the bomb and weighed as ammonium magnesium salt. The author shows that the method is quite as accurate as Carius', but is quicker and less hazardous. R. J. C.

Estimation of Phosphoric Acid in Acid Solution by means of Alkaline Molybdate Solution and Gelatin. A. Grete (*Ber.*, 1909, 42, 3106—3115).—In a previous paper (Abstr., 1888, 1341) the author has described the estimation of phosphoric acid in acid solution by means of acid molybdate solution and gelatin. The acid molybdate solution does not keep its titre, however, and the rubber tubing of the containing apparatus is attacked by the nitric acid. These difficulties have been overcome by the use of an ammoniacal molybdate solution; the acid which is necessary for the completion of the precipitation is added to the phosphate solution, which has been neutralised previously.

The method is a volumetric one and depends on the fact that in the presence of gelatin, the phosphomolybdate precipitate appears white, and is very voluminous, so that the presence of very small quantities of phosphoric acid can be detected. On boiling, the precipitate assumes the ordinary compact, yellow form and quickly settles, so that more molybdate solution may be added to see if any further precipitate is produced.

Very full details are given for the preparation and standardisation of the various solutions used, and also of the manner in which the determination must be carried out. The method can be used for the estimation of phosphorus in all ordinary cases, and only in the presence of much iron is it necessary to modify it. It has been tested in more than 100,000 analyses. T. S. P.

Estimation of Graphite. Frank Browne (*Chem. News*, 1909, 100, 162).—Satisfactory results have been obtained by the author in the assay of a sample of "Acheson Graphite" by means of the process published previously (Abstr., 1908, ii, 896), consisting in burning the sample with a fixed quantity of a specially prepared iron oxide.

L. de K.

New "Boat" for Organic Analysis. Marcel Delépine (*Bull. Soc. chim.*, 1909, [iv], 5, 876—877).—The boat consists of a piece of platinum foil measuring 15 × 1·4 cm., in which four oval depressions, each 2 cm. long, 0·7 cm. broad, and 0·3 cm. deep, are hammered in one line at intervals of 2 cm., beginning at 0·5 cm. from one end. Between the inner ends of the first and fourth depressions the platinum foil is cut away to the same diameter as the depressions, except at the centre, where for a short distance the original diameter (0·7 cm.) is retained to form a pair of central flanges. A boat of this size is used in the ordinary manner in a combustion tube of 1·7 cm. diameter in which it rests on the flanges at its ends and centre. The substance to be burned is distributed between the four depressions. It is claimed that by the use of this boat combustion takes place more uniformly and with less risk of loss due to "rushes" of carbon dioxide.

T. A. H.

Separation of Silica from Silicon and Carbon. Erhard Britzke (*Chem. Zeit.*, 1909, 33, 1098—1099).—The author states that when heating a mixture containing silicon, carbon, and silica, at a sufficiently high temperature, in a current of hydrogen chloride, not only the silicon, but also the carbon, is ultimately volatilised, and only the silica remains.

Advantage of this reaction may be taken in the analysis of ferrosilicon and similar compounds. The iron also volatilises completely. The silica remaining should be examined for possible traces of non-volatile chlorides. L. de K.

Volumetric Estimation of Silver by Gay-Lussac's Method. Ernesto Pannain (*Gazzetta*, 1909, 39, ii, 240—249).—The author has devised an apparatus for determining the end-point of the titration of a silver solution with standard sodium chloride solution. It consists of a glass tube 8—10 cm. long and about 3 cm. wide, open at the top and sealed at the bottom to a second tube 20—25 cm. long and 4—5 mm. in diameter, which passes through one hole of a doubly-bored stopper fitted to the titration vessel. At a short distance from the wide tube, the narrower one is enlarged, the enlarged part being packed with asbestos between two layers of glass wool. A side-tube, bent twice at right angles, enters the narrow tube just above and just below the enlargement, the vertical part of the side-tube being fitted with a tap. By this means, the liquid which has been forced up through the asbestos filter into the wide tube (by means of a filter-pump connected with this tube), and there tested to ascertain whether silver or chlorine is in excess, can be returned, by opening the tap, into the titration vessel without passing again through the filter; the upper surface of the latter is thus kept free from precipitate, which would render turbid subsequent portions of liquid passed through the filter. This apparatus hence represents an improvement on the forms devised by Tarugi and Bianchi (Abstr., 1906, ii, 627) and by Lang and Allen (Trans., 1907, **91**, 1370).

The maximum error of the method is 0·015%, and this may be diminished by careful working (compare Lang and Woodhouse, Trans., 1908, **93**, 1037). T. H. P.

Iodometric Estimation of Silver based upon the Reducing Action of Potassium Arsenite. Rowland S. Bosworth (*Amer. J. Sci.*, 1909, [iv], **28**, 287—290; *Zeitsch. anorg. Chem.*, 1909, **64**, 189—192).—To the silver solution is added a definite volume of standard potassium arsenite and then an excess of a saturated solution of sodium hydrogen carbonate. The mixture is boiled to precipitate the silver as metal, and, after filtering (this is not strictly necessary), the liquid is acidified with hydrochloric acid and then again made alkaline with sodium hydrogen carbonate. The excess of arsenite is titrated with standard iodine. In the presence of other metals, the silver is precipitated first with hydrochloric acid, and the chloride is then dissolved in ammonia. After suitable dilution, standard arsenite is added, and, after boiling, the excess of this is determined in the manner described.

1 mol. of arsenious oxide = 4 ats. of silver. L. de K.

Micro-chemical Analysis. VIII. The Insoluble Substances. Nicolaas Schoorl (*Zeitsch. anal. Chem.*, 1909, **48**, 678. Compare this vol., ii, 762, 831).—After heating moderately to obtain a sublimate of sulphur, if any, the substance is boiled with a drop of water and the solution is carefully decanted, mixed with a drop of acetic acid, and left to crystallise; the slide is then examined for calcium sulphate. Any undissolved residue is heated with a drop of strong sulphuric acid and then left to crystallise. Barium, strontium, and lead sulphates separate. The sulphuric acid is now completely expelled by heating, and from the residue any silver sulphate derived from silver halides may then be extracted with a drop of water. On treating the residue with hydrochloric or nitric acid, the oxides of tin, antimony, iron, aluminium, and chromium dissolve in quantity sufficient for recognition. Lead sulphate may be extracted previously with ammonium acetate.

Insoluble silicates are treated with hydrofluoric acid or a mixture of ammonium fluoride and sulphuric acid to expel the silica. The base may then be readily tested for by the processes already described. Fluorides are treated with hydrochloric acid and precipitated silica.

L. de K.

Estimation of Calcium Carbonate in Soils. Francis S. Marr (*J. Agric. Sci.*, 1909, **3**, 155—160).—A soil freed from any trace of calcium carbonate originally present by treating with cold 5% hydrochloric acid and keeping for several hours in a vacuum over sodium hydroxide yielded 0·422, 0·224, and 0·211% of carbon dioxide when boiled for three successive periods of twenty minutes. Similar results, showing the production of carbon dioxide from organic matter by boiling with dilute hydrochloric acid, were obtained with a second soil.

The most satisfactory method for estimating carbonates was found to be the following: The soil is boiled with very dilute hydrochloric acid (5 c.c. of strong acid diluted with 100 c.c. of water) for about twenty minutes under reduced pressure, the carbon dioxide being absorbed by 4% sodium hydroxide in a Reiset tower and determined by the double titration method.

Carbonates may also be estimated by boiling the soil with a solution of an ammonium salt. A current of air free from carbon dioxide is passed through the distilling flask, then through an acid trap to retain the ammonia, and finally through a Reiset tower to absorb the carbon dioxide, which is determined by double titration.

This method is liable to give slightly high results, as it is shown that some soils contain organic matter which gives off carbon dioxide even when boiled with water alone. N. H. J. M.

Estimation of Barium Sulphate in Presence of Interfering Substances. M. J. VAN'T KRUYS (*Chem. Weekblad*, 1909, 6, 735—758).—The process is based on the fact that in presence of much calcium the barium sulphate obtained contains calcium sulphate, but is free from potassium, sodium, magnesium, iron, or cobalt. The co-precipitated calcium may be readily removed, and in this way a perfectly pure barium sulphate is left.

To the liquid, which should not contain too much acid, is added an amount of calcium chloride doubly sufficient for combining with the sulphuric acid present, and the boiling solution is then precipitated with a 10% solution of barium chloride; this should be added drop by drop until the amount used exceeds twice the quantity required. The solution is now boiled, and hydrochloric acid is added until the quantity amounts to about 20% of 38% acid, or a mixture of hydrochloric and nitric acid (3 : 1) is used in such quantity that the acidity amounts to 10%. The whole is now boiled gently for three hours with an occasional addition of a few c.c. of nitric acid if aqua regia has been used. After allowing the barium sulphate to deposit for a moment, the liquid is poured off as much as possible and evaporated in a glass basin to near dryness. Meanwhile, the precipitate is again boiled with 150 c.c. of 20% hydrochloric acid (or dilute nitrohydrochloric acid) and a few c.c. of barium chloride for three hours, and, after decanting, the operation is repeated once more. The acid liquids are all evaporated in the same dish. The residue is now taken up with boiling water, and the whole returned to the beaker containing the barium sulphate. In presence of iron, however, the residue should be heated first with about 0·5 c.c. of hydrochloric acid and a few drops of nitric acid in order to dissolve the basic iron salts.

After boiling for a few minutes, the barium sulphate is collected and washed as usual, and may be trusted to be pure enough for scientific purposes. The results of sixty-eight experiments are given in a table. L. DE K.

Solubility of Barium Sulphate in Ammonium Acetate Solutions. GIUSEPPE KERNOT (*Rend. Accad. Sci. Fis. Mat. Napoli*, 1909, [iii], 15, 155—156).—In the analysis of galena, the usual method of separating the lead from the barium consists in treating the mixed sulphates, obtained by the action of nitric acid, with ammonium acetate solution, which dissolves the lead sulphate. The author finds, however, that the results yielded by this method vary with the concentration of the ammonium acetate solution employed, owing to variations in the amount of barium sulphate dissolved by this solvent. Measurements of the solubility of barium sulphate in ammonium acetate solutions of increasing concentrations at 25° show that the solubility reaches its maximum (0·133 gram per litre) with a solution containing about 300 grams of ammonium acetate per litre, and then again falls as the amount of the salt is increased. T. H. P.

Estimation of Magnesium Chloride in Water. HERMANN EMDE and RICHARD SENST (*Zeitsch. angew. Chem.*, 1909, 22, 2038—2040). —A criticism of Pfeiffer's process (*ibid.*, 435). In this process the water, after being carefully neutralised with sulphuric acid, is evaporated to dryness, and the residue heated for an hour at 400—450°. In the meanwhile the chlorine is estimated as usual. The difference between the chlorine contained in the water and that left in the residue represents magnesium chloride.

The authors state that the process is untrustworthy for several reasons. First of all, magnesium chloride requires a higher temperature for decomposition (550—600°), and secondly, the process will always show the presence of magnesium chloride, although none may be present in the water, owing to the interaction of chlorides at a high temperature on magnesium sulphate, etc. L. DE K.

Estimation of Magnesium Chloride in Water. PFEIFFER (*Zeitsch. angew. Chem.*, 1909, 22, 2040).—A reply to Emde and Senst (preceding abstract). The author upholds his process and states that the apparent loss in chlorine on heating magnesium sulphate with sodium chloride is due to a sparingly soluble compound of anhydrous magnesium sulphate with sodium chloride. This, however, dissolves completely on extracting repeatedly with hot water. L. DE K.

Simplification of Mosander's Method for the Separation of Cerium from the other Ceritic Earths. OTTO HAUSER and F. WIRTH (*Zeitsch. anal. Chem.*, 1909, 48, 679—692).—Small quantities of cerium in ceritic earths may be estimated as follows: About 60 grams of the mixed nitrates are precipitated with ammonia and the excess is boiled off. After adding 40 c.c. of 3% hydrogen peroxide, a rapid current of chlorine is passed for half an hour. The precipitate is freed from other ceritic compounds by redissolving in nitric acid and reprecipitation as described. It is finally converted by ignition into cerium dioxide.

A special precipitating flask with stirrer is described, the object of which is to prevent the unpleasant effects of the chlorine.

L. de K.

[Estimation of] Iron and Copper in Cheese Curds. A. Schaeffer (*Milchw. Zentr.*, 1909, 5, 425—430).—*Estimation of Inorganic Iron.*—Twenty grams of the curds are rubbed in a porcelain mortar with about twenty drops of ammonia, D 0·96, until the mass has become transparent. Five drops of yellow ammonium sulphide are next added, and, after triturating the mass, it is placed on a plate of porcelain or opaline glass. After ten minutes, the colour is compared with a colour scale showing amounts of iron varying from 0·0, 0·0003, 0·0007, 0 001, and 0·002%. Organically combined, or naturally occurring, iron is not indicated by this test.

Estimation of Copper.—A simple test for copper similar to the above has not yet been worked out. The curd must be burnt in presence of sodium carbonate and a little potassium nitrate, and the ash tested for copper in the usual manner. L. de K.

Sanchez's Process for the Separation of Nickel and Cobalt. Hermann Grossmann (*Zeitsch. angew. Chem.*, 1909, 22, 2005—2006).—The author having tried Sanchez's process (this vol., ii, 621), states that, although based on an interesting reaction (behaviour of the complex cyanides with silver nitrate), it cannot be recommended for analytical purposes.

First of all the preliminary separation of cobalt and nickel sulphides from the other metals of the ammonium sulphide group by means of dilute hydrochloric acid is known to be inaccurate. Again, the final precipitation of the nickel by means of bromine and sodium hydroxide does not yield an oxide of a constant composition. L. de K.

Estimation of Molybdenum in Molybdenite. E. Collett and Moritz Eckardt (*Chem. Zeit.*, 1909, 33, 968—969).—The methods for the estimation of molybdenum are reviewed, and the loss of weight in igniting molybdic acid is recorded in the form of a curve. The following method is recommended.

The finely powdered molybdenite (0·3 gram) is digested with 25 c.c. of fuming nitric acid for two to three hours, the solution evaporated, and the residue heated with 1—2 c.c. of concentrated sulphuric acid, dissolved in 50 c.c. of water, and filtered while warm. The residue is washed on the filter with water, dilute ammonia, and again with water. Ammonia is added to the united filtrates until iron and alumina are precipitated, the filtrate is then concentrated to 150—200 c.c., and an excess of ammonium sulphide added. Copper sulphide is filtered off, the filtrate warmed with hydrochloric acid, and the molybdenum sulphide collected. The filtrate is evaporated, most of the ammonium salts expelled by heat, the residue dissolved, and ammonia and ammonium sulphide added. The two molybdenum sulphide precipitates are united, and weighed after ignition with sulphur in hydrogen as MoS_2. C. H. D.

Analysis of Molybdenite. WOLDEMAR TRAUTMANN (*Chem. Zeit.*, 1909, 33, 1106—1107).—The following process is recommended: 0·3 gram of the ore, which need not be very finely powdered, is mixed with a mixture of equal parts of sodium peroxide and sodium hydroxide and heated in a covered nickel crucible, gently at first, and then for five minutes at a bright red heat. When cold, the mass is dissolved in hot water, and the liquid filtered off from any undissolved matter. To the filtrate is added an excess of yellow ammonium sulphide, and, after warming on the water-bath, a slight excess of dilute sulphuric acid is cautiously added. After removing the excess of hydrogen sulphide by means of a current of air, the precipitate is collected and washed. When dry, it is detached from the filter, the filter-ash is added, and the whole converted into molybdenum trioxide by heating in a porcelain crucible over a very small flame. The precipitate may also be weighed as sulphide (preceding abstract). L. DE K.

Coloration in Peroxidised Titanium Solutions; Colorimetric Methods of Estimating Titanium and Fluorine. H. E. MERWIN (*Amer. J. Sci.*, 1909, [iv], 28, 119—125).—An investigation showing that in the colorimetric estimation of titanium, and the indirect colorimetric estimation of fluorine (which has a bleaching effect on the titanium solution oxidised with hydrogen peroxide), due notice should be taken of the amount of alkali sulphate present, and also of the temperature and free acidity. L. DE K.

Analysis of Sulphur Antimonii Auratum. FELIX JACOBSOHN (*Gummi Zeit.*, 1909, 23, 1075. Compare Abstr., 1908, ii, 540).—When antimony pentasulphide is distilled with concentrated hydrochloric acid, the estimation of the sulphur combined as hydrogen sulphide gives untrustworthy results, it being found that varying amounts of the free element combine to form an excess of hydrogen sulphide beyond that required by the formula $Sb_2S_5 + 6HCl = 2SbCl_3 + 3H_2S + S_2$. F. M. G. M.

Estimation of [Tantalic and Columbic] Acids. LUDWIG WEISS and MAX LANDECKER (*Zeitsch. anorg. Chem.*, 1909, 64, 65—103).—Columbic acid, precipitated by sulphuric acid, retains this acid, and the usual method of removal by igniting with ammonium carbonate is unsatisfactory. If the acid is neutralised with ammonia, the precipitate settles well, and is readily washed free from sulphate with dilute ammonia. It is, however, better to precipitate from the alkaline solution with acetic acid. Iron is best removed by dissolving the freshly precipitated acid in a mixture of oxalic and tartaric acids, adding ammonia, and passing a current of hydrogen sulphide, the iron alone being precipitated. The complex columbic or tantalic oxalates crystallise well from the filtrate, and yield the pure acids on ignition (see also Giles, this vol., ii, 352). Aluminium is not removed by this treatment.

For separation from all other elements except titanium, the sulphuric acid suspension is heated with sulphur dioxide; the precipitate then contains only columbic and tantalic acids, together with any insoluble sulphates. Any tin in the precipitate may be removed with ammonium sulphide. To remove calcium sulphate, etc., warm sulphuric acid and hydrogen peroxide are added, when the earth acids dissolve completely.

In the alkaline fusion of mixtures containing titanium, a compound of titanium and columbium appears to be formed to some extent; this is hindered by the addition of an oxidising agent to the alkali. For the quantitative estimation, sodium nitrate is used. After dissolving in water and filtering, very little titanium remains in solution, and this is completely precipitated by hydrogen sulphide without carrying down the other earth acids. Sodium peroxide and borax gave incomplete separations. A mixture of six parts potassium cyanide and one part potassium hydroxide effects complete separation, the titanium becoming insoluble. Sodium carbonate and sulphite, and various acid mixtures, fail to give a complete separation.

Columbic and tantalic acids are best separated from one another by fusing with sodium carbonate and nitrate, dissolving in warm water, cooling, and precipitating tantalum with carbon dioxide. Slight variations in the conditions diminish the accuracy of the separation.

For the complete analysis of minerals, the material is fused with potassium hydrogen sulphate until clear, extracted with hot water containing sulphuric acid, and sulphurous acid is added to the boiling solution until the precipitate becomes flocculent. After twenty to thirty minutes' boiling, the precipitate is collected and washed with sulphurous acid. The residue, containing tantalum, columbium, titanium, and tin, is neutralised with ammonia, extracted with ammonium sulphide, heated in a platinum crucible, and fused with sodium carbonate and nitrate. The analysis is completed as above. Several complete analyses of tantalite are given.

The paper concludes with a list of the qualitative reactions of tantalum and columbium. C. H. D.

Determination of the Degree of Polution of Sea-water by the Estimation of the Organic Matters. C. Lenormand (*Bull. Sci. Pharm.*, 1909, 16, 253—258).—To 100 c.c. of the clear but not filtered sample are added 1 gram of pure potassium carbonate and 10 c.c. of permanganate solution (made by dissolving 3·95 grams of the salt up to 1 litre of water and diluting this tenfold before use). The liquid is boiled for ten minutes, and then cooled rapidly and diluted to 100 c.c. It is then introduced into a suitable colorimeter, and compared with a standard made by diluting 10 c.c. of the dilute permanganate to 100 c.c. The loss in permanganate, which is then expressed in oxygen, is thus readily ascertained. The use of a suitable green glass in order to absorb the red colour is recommended. In some experiments made, the oxygen absorbed by the water agreed very well with the number of bacteria present, and the author thinks that in most cases the chemical test will suffice.

The self-purification of sea-water appears to take place with amazing rapidity. L. de K.

Detection of Nitronaphthalene in Mineral Oils. Ferd. Schulz (*Chem. Zeit.*, 1909, 33, 1093).—Ten grams of the mineral oil, or a mixture of mineral and vegetable oil, are mixed with 0·5 gram of American rosin and heated in a tube to 290—300°. After cooling to 80°, 4 grams of 10% sulphuric acid are added, and the whole is well shaken; the tube is then placed in a boiling-water bath, and, after some time, the acid layer is drawn off. On adding a few c.c. of cold saturated potassium dichromate, an azure-blue precipitate of aminonaphthol is obtained even with as little as 0·05% of nitronaphthalene. The precipitate may be washed with dilute alkali and then with water, and further identified by the fact that its alcoholic solution has a rose colour and its solution in benzene a cherry-red colour, or, if very dilute, a rose-red one. L. DE K.

Detection of Allyl Alcohol and its Derivatives. GEORGES DENIGÈS (*Bull. Soc. chim.*, 1909, [iv], 5, 878—879).—Two groups of colour reactions are described, depending on the formation from allyl alcohol of (1) glyceraldehyde and (2) dihydroxyacetone, and the condensation of these products with various reagents.

Bromine water (0·6 c.c. in 100 c.c. of water) is added to 0·1 c.c. of allyl alcohol until a slight permanent coloration is obtained, and the liquid is then boiled, allowed to cool, and divided into portions of 0·4 c.c. To each of these, 0·1 c.c. of a 5% solution of codeine, resorcinol, thymol, or β-naphthol is added, followed by 2 c.c. of sulphuric acid (D = 1·84), and the mixture warmed during three or four minutes at 100°. Codeine and thymol give reddish-violet colorations, resorcinol wine-red, and β-naphthol yellow with a greenish fluorescence.

The second group of colour reactions is obtained by adding to the brominated liquid, obtained as described above, 5 c.c. of bromine water (0·6 c.c. in 100 c.c. of water), heating during twenty minutes at 100°, then boiling to remove excess of bromine, and cooling. This preparation gives the usual colour reactions of dihydroxyacetone (this vol., ii, 272, 273, 448). T. A. H.

Estimation of Essential Oil and Eugenol in Cloves. R. REICH (*Zeitsch. Nahr. Genussm.*, 1909, 18, 401—412).—The essential oil is separated by subjecting the cloves to steam distillation; for this purpose a weighed quantity of from 10 to 20 grams of the cloves is ground up with pumice-stone and placed in a brass cylinder provided with a perforated false bottom; a second cylinder fitting over the top of the first serves as a cover. This second cylinder contains a spiral spring attached to a disk, which presses on the mixture in the first cylinder. A tube leading from the bottom of the latter is connected with a steam-boiler, whilst a tube at the top of the second cylinder or cover is attached to an ordinary Liebig condenser. The cylinders are surrounded by a steam-jacket supplied with steam from the boiler. About 200 c.c. of distillate are collected and saturated with sodium chloride, the essential oil being then extracted with pentane. The pentane solution is evaporated in the manner described previously by the author (Abstr., 1908, ii, 1075), and the residue of essential oil is weighed. The quantity of eugenol in the essential oil is ascertained by heating 1·5 grams of the oil with 20 c.c. of 5% sodium hydroxide solution on a water-bath and under a reflux apparatus.

After being heated for fifteen minutes, the mixture is cooled and the undissolved portion of the oil is removed by extraction with light petroleum. The alkaline solution is then diluted with 5% sodium hydroxide to a volume of 30 c.c., of which 15 c.c. are shaken with 5 c.c. of 25% sulphuric acid, 6 grams of sodium chloride, and 20 c.c. of pentane. When the pentane has separated, an aliquot part of it is transferred to a weighed vessel, the pentane is evaporated as described previously, and the residue of eugenol is weighed. The following percentage quantities of essential oil and eugenol were found in various samples of cloves:

	Essential oil.	Eugenol.
Amboyna cloves	21·3—22·1	17·0—17·6
Zanzibar ,,	18·4—20·1	15·4—16·6
Ground ,, (commercial)	17·0—19·3	15·5—16·3
Clove stalks	5·8— 6·7	5·4— 5·7

W. P. S.

Presence of Inositol as a Characteristic of Natural Wines. G. Meillère (*J. Pharm. Chim.*, 1909, [vi], 30, 247—249).—Referring to Perrin's suggestion (this vol., ii, 624), that since inositol occurs in all natural wines, its detection serves to distinguish these from artificial wines, the author points out that he had already drawn attention to this method of identifying natural wines (*J. Pharm. Chim.*, 1908, [vi], 30, October). Perrin's method of isolating and characterising inositol is criticised in comparison with the author's own method (Abstr., 1906, ii, 811). T. A. H.

New Method of Working in the Estimation of Sugars by Bonnan's Process. P. Maillard (*Ann. Chim. anal.*, 1909, 14, 342—348, 370—374).—A table is given showing the factor to be used in the estimation of dextrose, which figure varies considerably with the time taken up in the titration with Bonnan's copper solution. For lactose, a special table has been constructed. The tables also give divisors by which the amount of dextrose or lactose per litre can be obtained. From the amount of dextrose found, the equivalent amount of inverted sugar is obtained by dividing by 0·96, and that of lævulose by dividing by 0·923.

Actual Operation.—In the case of very weak solutions a definite amount of pure dextrose solution (8 grams per litre) may be added and allowed for; 10 c.c. of Bonnan's copper solution, 10 c.c. of tartrate solution, 5 c.c. of ferrocyanide solution, and 0·25—0·30 gram of pumice are placed in a short-necked, 100—150 c.c., flat-bottomed flask, and heated with a Bunsen burner in such a manner that boiling starts after two and a-quarter to two and a-half minutes. After two and a-half minutes, the liquid should be actively boiling, and the sugar solution may now be added from a burette with stopcock.

The nozzle of the burette is placed at a distance of 1 cm. above the neck of the flask, and the dextrose solution is run in at the rate of 2—6 c.c. per minute. The moment the first drop is added, the time is noted, and the instant the liquid turns yellow, the stopcock is regulated with the fingers, and turned off at once when a brown precipitate forms.

The exact time taken up by the titration is then recorded, and reference is made to the tables. If the amount of dextrose solution required exceeds 12 c.c., 0·1 c.c. should be deducted for every 1 c.c. used in excess.

In the case of lactose, the solution should not be added too rapidly to the copper solution. Maltose behaves like lactose, but the result expressed as lactose must be divided by 0·848.

Processes are also given for rendering the method applicable to urines and milks. L. de K.

Detection of Sucrose and Sugars in General. M. Emmanuel Pozzi-Escot (*Bull. Assoc. chim. Sucr. Dist.*, 1909, 27, 179—180).—The test described previously (Abstr., 1908, ii, 740) is rendered more sensitive if 1 c.c. of 5% ammonium molybdate solution is added to 2 c.c. of the sugar solution, and this mixture then poured on the surface of the sulphuric acid. A blue coloration is obtained at the junction of the liquids if as little as 0·0005 gram of sucrose is present, and 0·00002 gram may be detected if the aqueous layer is heated. The coloration is also given by other carbohydrates, but is not so intense as in the case of sucrose. W. P. S.

Explanation of the Colour Reactions of Sugars. Reactions Due to the Formation of 2-Hydroxy-4-methylfurfuraldehyde. Reactions of Pettenkofer and Seliwanoff. Jules Ville and Eugène Derrien (*Bull. Soc. chim.*, 1909, [iv], 5, 895—901).—It has been shown already (Ville, Abstr., 1907, ii, 913, and Ville and Derrien, *Compt. rend. Soc. Biol.*, 1909, 66, 175) that Mylius' assumption (Abstr., 1887, 1149) that Pettenkofer's reaction is due to the formation of furfuraldehyde is inaccurate (compare Denigès, this vol., ii, 448). Kiermayer has observed (Abstr., 1896, i, 144) that by the action of oxalic acid on lævulose, 2-hydroxy-4-methylfurfuraldehyde is obtained. The authors now find that if the latter substance, or the anhydride into which it passes readily (*loc. cit.*), be substituted for lævulose or sucrose in Pettenkofer's reaction, the colour produced is identical spectroscopically with that obtained in the reaction as usually applied; whence they conclude that it is to the formation of this substance from the sugar and its condensation with bile acids that the coloration is due. Further, they show that this is also the mechanism of Seliwanoff's test for keto-sugars, the Boas reaction for hydrochloric acid in gastric juice, and of other similar tests. The fact that certain of the aldohexoses also give these reactions, although with difficulty, is explained by the suggestion that they may be converted into keto-hexoses by the action of the acid used. T. A. H.

The Author's Method for the Estimation of Glycogen, and the Specificity of Substances of the Animal Body. Eduard Pflüger (*Pflüger's Archiv*, 1909, 129, 362—378).—Further experiments have been carried out by Francke under the author's direction which show that glycogen is not altered by heating either with dilute or concentrated potassium hydroxide solutions. The errors obtained by heating organs with dilute alkali for the purpose of isolating glycogen are due possibly to the fact that the protein is not entirely destroyed, and this carries down with it some glycogen. The glycogen may also undergo change during the process of isolation by the ferments of the organ. For these reasons, a stronger alkaline solution is advisable. The best concentration is 30%. The method of separating the glycogen from organs is given in detail by the author, who, in conclusion, calls attention to the fact that the same glycogen is obtained from all species of animals, contrasting this with the species differences in the proteins.

S. B. S.

Separation of Mixtures of Some Aliphatic Acids by means of Benzene and Toluene. THOMAS R. HODGSON (*Analyst*, 1909, 34, 435—436).—Lasserre (Abstr., 1907, ii, 991) having communicated a process for the separation of volatile fatty acids by shaking the aqueous solution with benzene, the author has investigated the method and found that the process cannot lay claim to accuracy, although by due observance of conditions it may be of some utility.

The best results are obtained when the acid solutions to be extracted are shaken with twice the volume of benzene; toluene has no advantage over benzene. L. DE K.

Experiments on the Separation of Mixtures of Some Aliphatic Acids by means of Benzene. CHARLES A. KEANE and PERCIVAL NARRACOTT (*Analyst*, 1909, 34, 436—438).—An investigation of Lasserre's process (see preceding abstract). From experiments made with formic acid, acetic acid, propionic acid, *m*-butyric acid, *iso*butyric acid, and *iso*valeric acid, it is shown that the separation of their aqueous mixtures by means of benzene is influenced by the proportions and concentrations of the acids, and that the method does not therefore rest on a satisfactory principle. L. DE K.

Estimation of Fatty Matters in Fæces. A. CHAPUS (*J. Pharm. Chim.*, 1909, [vi], 30, 301—304).—Ten grams of the well mixed sample are triturated with 20 grams of anhydrous sodium sulphate, the dry mass is introduced into an extraction tube, and the mortar is rinsed with another 5 grams of sodium sulphate. In the case of very liquid fæces, the quantity of sodium sulphate should be increased.

The mass is extracted with anhydrous ether, which is then recovered by distillation. The residue is dissolved in 50 c.c. of hot alcohol, and titrated with *N*/10-potassium hydroxide. This gives the amount of free fatty acids calculated as stearic acid. Another 10 grams of the sample are then treated as before, after first adding a slight excess of hydrochloric acid to decompose any soapy matter. The ethereal extract is then evaporated in a weighed dish, and the residue, after drying in a vacuum over sulphuric acid, is weighed. It is then dissolved in alcohol and titrated with *N*/10-potassium hydroxide, using phenolphthalein as indicator. From the result obtained and after allowing for the free acids, the acids existing as soap and the neutral fat are readily calculated. L. DE K.

Leucine Fraction of Proteins. PHŒBUS A. LEVENE and DONALD D. VAN SLYKE (*J. Biol. Chem.*, 1909, 6, 391—418, 419—430).—Leucine and *d*-*iso*leucine may be separated quantitatively from *d*-valine as the normal lead salt. The relative proportion of the leucine isomerides may be determined polarimetrically in 10% hydrochloric acid solution; they may be separated from each other by Ehrlich's method of extracting their copper salts with methyl alcohol. The specific rotation of *iso*leucine is + 37·4°, instead of + 36·8° as given by Ehrlich. A comparison of the percentage figures obtained by the new method with those given by Abderhalden is as follows:

	From caseinogen.		From edestin.	
	New method.	Abderhalden.	New method.	Abderhalden.
Leucine	7·92	10·5	8·1	20·9
*iso*Leucine	1·43			
Valine	6·69	1·0	5·6	0·45

No doubt all previously published estimations of leucine in proteins require revision. W. D. H.

Volumetric Estimation of Thiocyanic Acid and the Causes of the Low Results. K. Schröder (*Zeitsch. öffentl. Chem.*, 1909, 15, 321—336).—As the result of a large number of experiments, the author arrives at the following conclusions. The decrease in permanganate consumed increases with the time of the titration. If the manganese is precipitated with sodium carbonate and then again redissolved by adding hydrochloric acid, more permanganate will be required to complete the reaction. If the solutions are very dilute, the air should be excluded.

The best results are obtained by adding an excess of permanganate to the hot solution acidified with sulphuric and phosphoric acids. The free permanganate is then titrated in the usual way with oxalic acid or hydrogen peroxide. Probably good results may be also obtained by rapidly titrating with permanganate in a current of carbon dioxide.

L. de K.

Jaffe's Colorimetric Method for the Estimation of Creatinine. A. Chaston Chapman (*Chem. News*, 1909, 100, 175 *).—The author has shown that Jaffe's picric acid test being due to a somewhat complex reducing action, it is clear that the conditions under which the test is carried out must be fairly closely defined if accurate results are to be obtained. The temperature is of paramount importance, as also, but in a less degree, is the time. The presence of dextrose does not seem to interfere when working with cold solutions. Attention is also called to the necessity of working with solutions sufficiently diluted. L. de K.

[Estimation of Quinine and its Excretion in Urine.] Paul Grosser (*Arch. exp. Path. Pharm.*, 1909, 61, 274. Compare Nishi, this vol., ii, 710).—Nishi objected to the author's method of estimating quinine by extraction with ether in presence of charcoal. The author calls attention to the fact, however, that the extraction was made with dried substance and not in the presence of liquids. S. B. S. //

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* and *Analyst*, 1909, 34, 475—483.

General and Physical Chemistry.

Indices of Refraction of Mixtures of Methyl Alcohol and Water. III. ANTONY G. DOROSCHEWSKY and S. V. DVORSCHANTSCHIK (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 951—958. Compare Abstr., 1908, ii, 241, 785).—For absolute methyl alcohol, D_{15}^{15} is 0·79047 and n_D^{15} 1·33057. For mixtures of methyl alcohol and water, the index of refraction increases to a maximum of n_D^{15} 1·34378 or $n_D^{17\cdot5}$ 1·34308 for a 50% solution. The temperature-coefficient, dn/dt, of the index of refraction varies quite regularly from 0·00040 for methyl alcohol to 0·00009 for water. The values of α, β, and γ (compare this vol., ii, 841) are calculated for each 10% of the alcohol from 10% to 90%, the mean (and limiting) values being 0·982 (0·973—1·000), 0·895 (0·883—0·913), and 1·126 (1·110—1·138) respectively, so that for aqueous methyl alcohol, just as for aqueous ethyl alcohol, the mean value for α is approximately the arithmetic mean of those for β and γ. For these mixtures there exists, as Pulfrich assumed (*Zeitsch. physikal. Chem.*, 1889, 4, 561), a constant relation between the contraction of volume and the contraction of refractive capacity.

From the numbers calculated by means of the three general formulæ for the refraction: $(n-1)/d$, $(n^2-1)/(n^2+2)d$, and $(n^2-1)/d$, firstly, without correction, and secondly, with introduction of the Pulfrich-Hess correction (compare this vol., ii, 1), it is seen that the most satisfactory uncorrected results are yielded by Gladstone's formula; the other two formulæ, even when corrected, give results less concordant than those of the Gladstone formula. The best results of all are obtained by means of the Gladstone formula with Pulfrich's correction:

$$(n-1)(1-ac)/d(1-c)$$

(*Zeitsch. physikal. Chem.*, 1889, 4, 561). T. H. P.

Determination of the Dispersion of Light in Non-Luminous Saturated Sodium Vapour at 385°. STANISŁAW LORIA (*Bull. Acad. Sci. Cracow*, 1909, 39—60).—The sodium vapour was contained in a transparent quartz tube, and the measurements of the dispersion were made by an interference method within the limits of the visible spectrum between $\lambda = 6\cdot145 \times 10^{-5}$ cm. and $\lambda = 5\cdot693 \times 10^{-5}$ cm. at 385°. The results are given in tables and curves, and it is shown that there is good agreement between the observed values and those calculated on the dispersion theory. An estimate is made of the ratio of the number of dispersion electrons to sodium atoms in equal volumes of the saturated vapour. G. S.

Spectrum of Magnesium Hydride. A. FOWLER (*Phil. Trans.*, 1909, *A*, 209, 447—478).—Photographs have been taken of the spectrum of an electric arc between magnesium rods in an atmosphere of hydrogen at a pressure of one to three inches of mercury. The wave-lengths of about two thousand lines composing the three principal flutings have been determined. The head lines in the various groups of flutings correspond with the wave-lengths 5621·57, 5211·11, 4844·92, 4371·8, and approximately 2430. The identification of magnesium hydride in the sun-spot spectrum is confirmed. The presence of the magnesium hydride flutings accords with the view that spots are regions of reduced temperature, and that their darkness is partly due to absorption. The question as to whether lines of magnesium hydride are present in the ordinary solar spectrum is not definitely settled, but it is probable that very few, if any, of the thousands of lines tabulated by Rowland are to be accounted for by this substance. H. M. D.

Chemical Reactions of Phosphorescence. Wilder D. Bancroft (*Zeitsch. physikal. Chem.*, 1909, 69, 15—18).—Regarding phosphorescence as a chemical reaction, eight possible types of reactions are suggested which might give rise to phosphorescence, and methods for differentiating between most of these are given. The question is to be investigated experimentally on the lines laid down. G. S.

Influence of Constitution on the Rotatory Power of Optically Active Substances. Hans Rupe (*Annalen*, 1909, 369, 311—369).—See this vol., i, 927.

Stereoisomerism of Internally Complex Salts. Heinrich Ley and H. Winkler (*Ber.*, 1909, 42, 3894—3902).—See this vol., i, 886.

Luminescence and Crystalline Form of Potassium Sodium Sulphate. B. A. Lindiner (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 961—986).—The author has studied the various kinds of luminescence exhibited by, and the crystalline form of, the double sulphate of potassium and sodium.

When crystals of the double sulphate separate from the mother liquor containing the two sulphates, the separation is always accompanied by luminescence, which may be observed repeatedly with one and the same solution; but if the separated crystals are dissolved in water, luminescence is not, as a rule, produced on crystallisation of the solution thus obtained, owing to the readiness with which the double sulphate decomposes into its constituents. The intensity of the luminescence occurring when the double sulphate separates, either alone or mixed with sodium sulphate, varies with the concentration of the solution, and is considerably more intense with a dilute solution concentrated at the ordinary temperature than with a hot saturated solution. The relative proportions of the two alkali sulphates also influence the luminescence, which is very slight with pure solutions of the double salt, $3K_2SO_4,Na_2SO_4,10H_2O$, and reaches its maximum intensity for a solution containing $2·5 - 2K_2SO_4$ and $1Na_2SO_4 + 10H_2O$. The luminescence is also more marked on the separation of well-developed crystals, such as are deposited from a solution containing $2K_2SO_4$ to Na_2SO_4, in a desiccator over phosphoric oxide, in which case it is apparent in daylight. Luminescence is observed only after the deposition of a certain amount of the crystals, the separation of each crystal being then accompanied by a spark, this process being capable of continuing for three hours.

The luminescence produced by shaking the crystals (triboluminescence) may be observed for some days after crystallo-luminescence has ceased. Very intense triboluminescence occurs when a glass rod or other hard substance is drawn over the crystalline magma beneath the mother liquor. The more intense the luminescence observed during the formation of the crystals, the more intense is the triboluminescence exhibited by the latter. Further, the luminescence produced by friction is of equal intensity with the single and twinned crystals.

Sparks are also observed when the crystals of the double sulphate are either heated or cooled—a phenomenon to which the author gives the name *pyroluminescence.* The thermoluminescence exhibited by certain minerals may also be due to the change of temperature and not merely to the heating. A parallelism exists between the pyroelectrical properties and the pyroluminescence.

The optical properties, relations of symmetry, twinning, and the etched figures of the crystals are also discussed. T. H. P.

Spontaneous Luminosity of a Uranium Mineral. ROBERT J. STRUTT (*Proc. Roy. Soc.*, 1909, *A*, 83, 70—71).—It has been found that specimens of recently-raised autunite from Portugal are self-luminous. The mineral is easily perceived in a perfectly dark room by a well rested eye. It is more luminous than uranium nitrate, but less so than potassium uranyl sulphate. Old specimens of autunite from Cornwall and from Autun do not show the phenomenon. The loss of luminosity is connected with a loss of water of crystallisation, for when the active autunite was sealed up in an exhausted vessel with phosphoric oxide it was found that the self-luminosity disappeared after a few hours. H. M. D.

Photochemical After-Effect. LUDWICK BRUNER and Z. ŁAHOCIŃSKI (*Bull. Acad. Sci. Cracow*, 1909, 265—267).—The photobromination of toluene is greatly retarded by the presence of oxygen. In order to remove the oxygen from a concentrated solution of bromine in toluene, the solution was submitted to the action of a strong light for a short time and then put in the dark until required. It was found, however, that the bromine was used up in a few minutes in the dark, because of a very pronounced photochemical after-effect. Investigation of this action has given the following results. When toluene is brominated in the dark in dilute solution, substitution takes place in the side-chain to the extent of 20% at 10° and 45% at 25°; bromination produced by the photochemical after-effect takes place exclusively in the side-chain. If the bromine (dissolved in carbon tetrachloride) and the toluene are separately exposed to the light and then mixed, there is no after-effect. Also, specially prepared mixtures of toluene, benzyl bromide, and hydrogen bromide do not show an abnormal bromination effect in the dark. The stronger the light in the photobromination the stronger is the after-effect; when the former is very weak, the latter disappears. The greater the concentration of the solution on which the after-effect is to be studied, the less pronounced is the after-effect.

The after-effect may last for hours, according to the quantity of bromine used in the photobromination. If more than twenty-four hours elapse between the photobromination and the bromination in the dark, there is no longer an after-effect. Cooling a photobrominated mixture to the temperature of liquid air does not weaken the after-effect, whereas heating to 100° for two hours destroys it. T. S. P.

Experiments on Solarisation. G. A. PERLEY (*J. Physical Chem.*, 1909, **13**, 630—658).—The theory of Abney, that oxidising agents facilitate reversal of the photographic image and reducing agents retard it, could not be confirmed in the cases of hypobromous acid and potassium permanganate. These oxidising agents have, however, a distinct clearing effect on the reversed image by retarding the formation of a second normal image. Such depolarisers as concentrated sodium nitrite applied to the plate before a long exposure give rise to very dense negatives of the metallic silver (doubly reversed) order, which mask the positive (reversed) image. With short exposures in a good light, a depolarised plate could be made to give a reversed (positive) image only, or a good negative of a dimly lit interior could be obtained by a short exposure of a "depolarised" plate which was developed immediately after exposure.

Exposure of a plate during development to greenish-blue light gave a good positive instead of a negative, particularly when potassium bromide and sodium carbonate were added to the stock developer. These positives were, however, too dense for lantern slides.

Sodium hypophosphate exerts a solvent action on the film, and gives rise to positive images after short exposures.

Thiocarbamide in Waterhouse's process for direct positives is found to produce its effect by increasing the sensitiveness of unexposed silver bromide so that it develops before the exposed bromide.

R. J. C.

Photoelectric Sensitiveness of Potassium as a Function of the Wave-length.—WILHELM HALLWACHS (*Ann. Physik*, 1909, [iv], **30**, 593—597). It has been assumed that certain metals show a maximum photoelectric effect for a particular wave-length of incident radiation. The behaviour of potassium has been examined in this connexion for wave-lengths ranging from 578$\mu\mu$ to 217$\mu\mu$. For this purpose the potassium was enclosed in a special form of cell, closed by a quartz plate, and provided with electrodes, which were connected with an electrometer circuit. The observations show that the specific photoelectric sensitiveness of potassium increases continuously as the wave-length of the incident radiation diminishes. The rate of increase is, moreover, considerably greater in the ultra-violet region than it is in the region of the visible spectrum. H. M. D.

Multiple Atomic Disintegration. A Suggestion in Radioactive Theory. FREDERICK SODDY (*Phil. Mag.*, 1909, [vi], **18**, 739—744).—The fact that the rate of disintegration of radioactive substances is independent of all known conditions suggests that the cause of disintegration is something apart from the radioactive atoms. If this is the case, it is conceivable that more than one condition of instability can exist within the atom at the same time, and the author suggests that multiple modes of disintegration may be proceeding simultaneously and independently within the same atom. The law of probability will apply to each mode of disintegration exactly as if it were the only one in operation, and the quantity of any radioactive element which undergoes such multiple disintegration will diminish exponentially with the time as in a simple disintegration process. The quantities of the products formed in the various modes of disintegration will be always proportional.

The view put forward gives a satisfactory explanation of the known relations between uranium, actinium and radium. H. M. D.

Mobility of the Radioactive Ions and the Mass of Gaseous Ions. J. Franck (*Ber. Deut. physikal. Ges.*, 1909, 11, 397—405).—The question as to whether the ions of gases consist of simple charged molecules or of complex molecular aggregates has been examined. With this object the author determined the mobility of the radioactive ions of thorium-*D* in air, nitrogen, and hydrogen. The ions of thorium-*D* were obtained by the use of plates on which thorium -*A*, -*B*, and -*C* had been deposited by exposing the negatively-charged plates to the influence of the emanation of a radio-thorium preparation.

The experimental data show that the mobility of the positively-charged thorium-*D* atoms is approximately equal to the mobility of the positive gaseous ions in air, nitrogen, and hydrogen. This leads to the conclusion that the gas ions are complex molecular aggregates, a result which is opposed to the recently-expressed view of Wellisch, that the gas ions consist of single atoms or molecules. H. M. D.

The Radioactivity of the Gases of the Wiesbaden Hot Springs. Ferdinand Henrich (*Zeitsch. Elektrochem.*, 1909, 15, 751—757).—The gases consist mainly of carbon dioxide and nitrogen with from 1·7 to 4·9% of argon, neon, and helium. The radioactivity is shown, by measurements of the rate of decay, to be due to radium emanation. The activity of the gases varies to a comparatively small extent from day to day, and the author attempts to find a connexion between these variations and variations of atmospheric pressure and other circumstances, but without success. T. E.

Attempt to Explain the Properties of Radium. Nicolai N. Beketoff (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 879—886).—In this paper the author develops his views, previously published (Abstr., 1903, ii, 623), on the causes of the phenomena exhibited by radium.
T. H. P.

Radium Content of Certain Igneous Rocks from the Sub-Antarctic Islands of New Zealand. C. Coleridge Farr and D. C. H. Florance (*Phil. Mag.*, 1909, [vi], 18, 812—816.)—As a result of the examination of various igneous rocks obtained from islands to the south of New Zealand, it is found that the mean radium content approximates closely to that found for other igneous rocks by Strutt, and by Eve and McIntosh. A comparison of the relative values for the radioactivity shows that this corresponds roughly with the basicity and not with the age of the rocks.

H. M. D.

A Typical β-Radiation of Radium. Otto Hahn and Lise Meitner (*Physikal. Zeitsch.*, 1909, 10, 741—745).—It is found that β-rays are not only emitted by radium-*B*, radium-*C*, and radium-E_2, but also by radium itself. When a drop of a strong solution of a radium salt is evaporated to dryness on a strip of platinum foil, and the residue heated strongly in the blow-pipe in order to volatilise the disintegration products of radium, the β-ray activity is found to reach a lower limiting value. The soft β-rays which are emitted by the non-volatile product represent about 1·2% of the whole β-ray activity of radium in equilibrium with the disintegration products. The rays are half absorbed by a layer of aluminium 0·00222 cm. in thickness, which corresponds with an absorption coefficient $\gamma = 312$ cm.$^{-1}$. On the assumption that every set of rays corresponds with a different substance, the authors conclude that what has been called radium previously is a complex substance. The observed facts seem to show that the newly-discovered β-rays are emitted by radium itself, whilst the α-rays are to be ascribed to its primary disintegration product, to which the name radium-*X* is given. H. M. D.

Some Numerical Constants of Radium Emanation and their Relation to those of the Inactive Gases. George Rudorf (*Zeitsch. Elektrochem.*, 1909, 15, 748—749).—From Ramsay and Gray's determinations (Trans., 1909, 95, 1073), the author calculates the values of *f* for radium emanation in the equation $\log p_k - \log p = f(T_k/T - 1)$, where p and p_k are the vapour pressure and critical pressure at the temperature, T, and critical temperature, T_k. The mean value is 2·23; the value for argon is 2·25; krypton, 2·39, and xenon, 2·38. The values of a and b in van der Waals' equation are (for a gram-molecule and pressure in metres): argon, $a = 9{\cdot}886 \times 10^5$, $b = 30{\cdot}18$; krypton, $a = 17{\cdot}63 \times 10^5$, $b = 39{\cdot}79$; xenon, $a = 31{\cdot}24 \times 10^5$, $b = 51{\cdot}57$; radium emanation, $a = 49{\cdot}3 \times 10^5$, $b = 62{\cdot}1$.

The molecular heat of evaporation calculated by Nernst's modification of Trouton's rule is 4387 cal., whilst from the increase of vapour pressure with temperature, it is calculated to be 3960 cal. at the boiling point. The mean values calculated in the same way for the inactive gases are: argon, 1657 cal.; krypton, 2208 cal.; xenon, 3026 cal.

Radium emanation, therefore, has physical properties which are in harmony with those of the inactive gases. T. E.

Spectrum of Radium Emanation. Herbert Edmeston Watson (*Proc. Roy. Soc.*, 1909, *A*, 83, 50—61.) Photographs of the spectrum of carefully purified radium emanation have been taken with a prism spectrograph, and also with a grating. A new method of determining the wave-lengths of the spectral lines without the usual comparison spectrum is described. The wave-lengths, intensities, and persistencies of the lines are compared with those of previous observers (Royds, this vol., ii, 206, 287; Rutherford and Royds, Abstr., 1908, ii, 787; Cameron and Ramsay, Abstr., 1908, ii, 786). The occurrence of xenon lines in the spectrum of the emanation obtained by Ramsay and Cameron is confirmed, but Royds's suggestion of accidental contamination with xenon is considered to be untenable. On the other hand, it is supposed that under the conditions obtaining in the experiments of Ramsay and Cameron, the emanation has undergone disintegration with the formation of xenon. Since copper electrodes were used in these experiments, it is suggested that copper may be the transforming agent, but the author considers that further evidence is required before such an assumption can be made. H. M. D.

Active Deposit from Actinium in Uniform Electric Fields. W. T. Kennedy (*Phil. Mag.*, 1909, [vi], 18, 744—757).—Experiments have been made to determine the factors which influence the separation of the active deposit from actinium in a uniform electric field. Circular electrodes, furnished with guard plates, were employed, and these were exposed to the actinium emanation for two hours before being examined. In most experiments the difference of potential between the electrodes was 250 volts.

When the electrodes were separated, the active deposit on both plates steadily decreased. When the distance between the plates exceeded 3 mm., no deposit was obtained on the anode, but that on the cathode only fell to about one-half when the distance between the plates was increased from 1 to 8 mm.

With increasing distance between the actinium and the electrodes, the amount of the active deposit on both anode and cathode was found to undergo a steady diminution.

From experiments in air, carbon dioxide, and hydrogen at different pressures, it was found that the active deposits on both electrodes increased with falling pressure, and that in both cases maximum values were reached, the activities afterwards diminishing with further reduction in the pressure. At pressures of the order of 1 mm. of mercury, the anode and cathode were found to be equally active. A comparison of the pressures corresponding with the maximum cathode and anode deposits for the three gases examined indicates that diffusion is of paramount importance in connexion with the deposition of the active disintegration products. Although the pressures corresponding with the maximum cathode deposits are considerably higher than those corresponding with maximum anode activity, the pressure ratios for the three gases are approximately the same for both cathode and anode.

In the absence of an electric field, the total deposit was found to be practically the same as in a uniform field if the pressure exceeded a certain value. For pressures lower than this, the total deposits were greater when the electric field was applied. H. M. D.

Positive Charge of the Canal Rays. Johannes Stark (*Physikal. Zeitsch.*, 1909, 10, 752—756).—The observations which led

Wien to put forward the view that the line spectra are due to neutral atoms are adversely criticised. The fact that the canal rays show the Doppler effect has already led the author to the conclusion that the line spectra are to be attributed to positively charged ions, and to ascertain the cause of the discrepancy between these two views, experiments have been made by a method similar to that employed by Wien. It is shown that the canal ray discharge in mercury vapour under otherwise constant conditions varies with the material of which the receiver is constructed. The ratio of the canal ray discharge to that of the primary glow discharge is of the order 10^{-4} in mercury vapour, whereas the same ratio in hydrogen is of the order 10^{-2}. This observation is in accord with the author's theory. H. M. D.

Positive Rays of Mercury. WILHELM WIEN (*Physikal. Zeitsch.*, 1909, **10**, 862. Compare Abstr., 1908, ii, 1006).—A reply to Stark (preceding abstract), in whose opinion the rays examined by the author were not canal rays, but a phenomenon resulting from the removal of positive and negative ions from the region of discharge by the stream of mercury vapour. It is pointed out, however, that the rays produce the characteristic fluorescence on the walls of the glass tube, and that no traces of mercury vapour could be detected in the region of observation. H. M. D.

Ultimate Product of the Uranium Disintegration Series. J. A. GRAY (*Phil. Mag.*, 1909, [vi], **18**, 816—818).—The uranium minerals autunite and torbernite were examined spectroscopically by introducing them into a carbon arc with calcium chloride to serve as a flux. The only lines in the spectra of the minerals which did not belong to one or other of the chief constituents were those of iron, lead, barium, and strontium. Of these, lead is the only one which cannot be regarded as an accidental impurity, and its presence is considered to support the view that lead is the ultimate product of the disintegration of uranium.

An approximately quantitative comparison of the spectra obtained with calcium chloride containing determined quantities of autunite and lead respectively showed that the mineral examined contains about 0·0001 gram of lead per gram. The time required for the formation of this amount is about a million years. H. M. D.

Radioactivity of Preparations of Zirconium. ALBERT GOCKEL (*Chem. Zeit.*, 1909, **33**, 1121).—The examination of various preparations of zirconium has shown that the radioactivity diminishes with increasing purity. Natural zircon gives rise to induced activity, and the rate of decay of this indicates that the radioactive impurity is thorium. The measurement of the radioactivity is suggested as a means of determining the degree of purity of zirconium preparations. H. M. D.

Electrionic Theory. PHILIP BLACKMAN (*J. Physical Chem.*, 1909, **13**, 609—629. Compare this vol., ii, 291).—A summary of results already published, giving tables of molecular conductivities of salts, ionic conductivities, etc. R. J. C.

Electrical Conductivity of Liquid Ammonia Solutions. III. Edward C. Franklin (*Zeitsch. physikal. Chem.*, 1909, 69, 272—303. Compare Abstr., 1900, ii, 382; 1905, ii, 298).—The electrical conductivity of solutions of twenty-three compounds, including a number of salts and organic substances, in liquid ammonia has been measured. The apparatus used was a modified form of that already described, and the method of manipulation is discussed in detail. The results are given in tabular form, and are also represented graphically, the molecular conductivities being plotted as ordinates against the logarithms of the dilutions as abscissæ.

Franklin and Gibbs (Abstr., 1907, ii, 840) have recently shown that the molecular conductivity of certain compounds dissolved in methylamine increases at first with dilution of concentrated solutions, reaches a maximum, falls to a minimum, and then tends towards a second maximum in very dilute solutions. The present experiments were undertaken in order to find whether solutions in ammonia showed similar behaviour, and therefore measurements were made with as concentrated solutions as possible. The behaviour in question—two maxima and an intermediate minimum—was observed very distinctly for solutions of copper nitrate, zinc nitrate, potassium mercuric cyanide, and, much less distinctly, for potassamide. Many of the other solutions give curves, which, although they show no maxima or minima, rise rapidly with dilution from concentrated solutions, then more slowly through a moderate range of dilution, followed by a more rapid rise towards a maximum. The second rise towards a maximum is supposed to correspond with that observed for aqueous solution.

It was observed in the course of the experiments that silver iodide is extremely soluble in liquid ammonia; a solution was prepared, of which 16·76 c.c. contained about 28 grams of silver iodide. G. S.

Conductivity and Viscosity of Dilute Solutions of Lithium Nitrate and Cadmium Iodide in Binary and Ternary Mixtures of Acetone with Methyl Alcohol, Ethyl Alcohol, and Water. Harry C. Jones and Edward G. Mahin (*Zeitsch. physikal. Chem.*, 1909, 69, 389—418. Compare this vol., ii, 539).—The paper deals mainly with the electrical conductivity of solutions of lithium nitrate and of cadmium iodide in binary mixtures of acetone with methyl alcohol, ethyl alcohol, and water. Measurements have been made at 0° and 25° in dilutions up to 200,000 litres; the results are given in tabular form, and are also represented graphically.

As regards solutions containing lithium nitrate, the curves obtained by plotting the electrical conductivities as ordinates against the composition of the binary mixtures containing acetone as abscissæ vary considerably in form, and in some cases show minima. In the highest dilutions, ionisation appears to be practically complete in pure water and in pure acetone, and nearly so in the binary mixtures. The value of μ_∞ for lithium nitrate in water at 25° is about 108, in acetone about 172. The product of viscosity and molecular conductivity, $\eta\mu_v$ (the highest value obtained for the latter being used), is about 0·70 for mixtures of acetone with methyl and ethyl alcohols, and is independent of temperature. The value of $\eta\mu_v$ for mixtures of acetone and water varies from 0·60 in pure acetone to about 1·0 in pure water. The temperature-coefficients of conductivity are throughout of about the same value as the temperature-coefficients of viscosity. Ostwald's dilution law holds approximately for solutions of lithium nitrate in pure acetone beyond a dilution of $v=200$, but not for more concentrated solutions. It is shown by freezing-point determinations that lithium nitrate is associated in solutions of moderate concentration, an observation which explains the low conductivity values obtained for solutions of this salt in binary mixtures containing acetone.

Corresponding measurements have been made for solutions of cadmium iodide, and the results are very similar to those obtained with lithium nitrate. Ostwald's dilution law applies to solutions of this salt in acetone from $v=5000$ to $v=50,000$, but not at higher or lower concentrations. The temperature-coefficient of the conductivity of solutions of cadmium iodide in acetone is negative when v exceeds 10,000. The value of $\eta\mu_\infty$ is not constant in binary mixtures containing the salt, probably owing to incomplete ionisation. G. S.

Supertensions in Organic Solvents. GIACOMO CARRARA (*Zeitsch. physikal. Chem.*, 1909, **69**, 75—80).—The measurements were made by the usual method, the current passing through the solution being plotted against the difference of potential, which was progressively increased. The break in the curve, indicating the point at which gas begins to be given off, was either read off directly, or determined graphically, by extending the two parts of the curve in the usual way. The metals, in the form of wire, were used as cathode, the anode being of platinum, and as electrolytes, normal solutions of sulphuric acid (in one or two cases potassium hydroxide) in methyl and ethyl alcohol respectively were employed.

The degree of supertension for hydrogen varied with the nature of the metal, but the values in each case were approximately the same in the two alcohols. For iron, cobalt, nickel, gold, silver, copper, and lead, the supertension varied only between 0·20 to 0·26 volt in methyl alcohol, and between 0·23 and 0·28 volt in ethyl alcohol. For most metals, the supertension is smaller in the alcohols than in water, but in a few cases is about the same.

It is suggested that the proved dependence of the supertension on the nature of the solvent may account for the fact that the rate of dissolution of metals by acids depends greatly on the nature of the solvent (Kahlenberg). G. S.

Galvanic Ennobling of Metals. CHARLES M. VAN DEVENTER and H. J. VAN LUMMEL (*Zeitsch. physikal. Chem.*, 1909, **69**, 136—147. Compare Abstr., 1908, ii, 12, 558).—The greater part of the work described in this paper has already been published (compare Abstr., 1908, ii, 12, 558). Further experiments are described on the ennobling of one metal with reference to a second which in ordinary circumstances stands below the first in the potential series. In most cases, ethyl alcohol, containing a trace of acid, was used as insulator. When, for example, a cell of the type

$$\mathrm{Cd} \mid n\mathrm{H_2SO_4} \mid \text{ethyl alcohol} \mid \mathrm{Mg}$$

is constructed, the current flows in the opposite direction to that observed under ordinary conditions when acid alone is used as electrolyte. G. S.

Electrochemical Potentials in Non-Aqueous Solvents. J. Neustadt and Richard Abegg (*Zeitsch. physikal. Chem.*, 1909, 69, 486—498).—The *E.M.F.*'s of a number of cells in which methyl alcohol, ethyl alcohol, acetone and pyridine have been used as solvents for the electrolytes have been measured. In most cases one half-element consisted of silver/silver nitrate, the latter being dissolved in the organic solvent, but a few measurements of concentration cells were also made, for example, $Cu \mid Cu(NO_3)_2, 0{\cdot}01N \mid Cu(NO_3)_2, 0{\cdot}0025N \mid Cu$, in methyl alcohol. When possible, measurements were made with silver, lead, copper, mercury, cadmium, zinc, and their respective salts in all four solvents. For the absolute values, the original paper must be consulted.

In general, the potential differences in methyl alcohol, ethyl alcohol, and acetone are approximately the same as in water, a result which shows that the ratio of the solution tensions of the metals in these four solvents is approximately equal. The results in pyridine solution differ considerably from those for the other solvents; this is probably due to the small ionic concentrations of the metallic ions in this solvent. It has been found that NO_3' migrates with silver towards the cathode in pyridine solutions, and it is suggested that the salt may be ionised in pyridine solution according to the equation:

$$Ag_2(NO_3)_2 \rightleftharpoons Ag_2NO_3^{\cdot} + NO_3'.$$

The above results appear to indicate that in the other four solvents the ions are not associated with the solvent to a great extent.

A number of measurements have been made with compound cells containing a number of liquid junctions, in order to elucidate the question of contact differences of potential. In this case, also, pyridine solutions behave abnormally, as the contact differences between them and other solutions are very considerable. G. S.

The Oxidation Potential of Manganese Dioxide. Wolfram Haehnel (*Zeitsch. Elektrochem.*, 1909, 15, 834—842).—An attempt was made to measure the concentration of the iodine formed in the reaction: $MnO_2 + 4H^{\cdot} + 2I' \rightleftharpoons Mn^{\cdot\cdot} + 2H_2O + I_2$. The concentration of the iodion was kept at a constant small value by adding excess of silver iodide, and the hydrogen ions were added in the form of hydrochloric acid. The results were erratic, which is also true of the corresponding reaction with bromine in place of iodine. Two causes of disturbance were discovered: the solubility of iodine in a 1·1 molecular solution of manganous chloride is $6{\cdot}23 \times 10^{-3}$, whilst its solubility in water is only $3{\cdot}7 \times 10^{-3}$ gram-mol. per litre, which indicates some combination; secondly, iodide is oxidised to iodate by manganese dioxide under the conditions of the experiments, where the concentration of the iodine ions is small enough to permit of the existence of measurable quantities of iodate ion. It is also shown that equilibrium is reached extremely slowly, and that the rate varies in different experiments from unknown causes. From the incomplete results, the author calculates the normal potential of manganese dioxide to be greater than 1·2 volts (compared with the hydrogen electrode). The potential which just deposits manganese dioxide from a solution of manganous sulphate is found to depend on the acidity of the solution. Calling e the observed potential, the normal potential, N, should be given by $N = e - 0{\cdot}0295 \log. [H^{\cdot}]^4/[Mn^{\cdot\cdot}]$; this formula agrees well with the observations, and gives $N = 1{\cdot}35$ volts.

When chlorine is passed into a neutral or faintly acid solution of manganese chloride, the dioxide is precipitated. It is found that in a 0·22N solution of manganous chloride, precipitation occurs when the concentration of the hydrogen ions is 0·0101, and does not occur when it is 0·013 gram-mol. per litre. This result leads to a value of about 1·57 volts for the normal potential of manganese dioxide, but in calculating this the formation of manganic chloride in the solution is neglected, the effect of which is to make the calculated value too large. T. E.

Solubility of Manganous Hydroxide and the Dissociation Pressure of Manganese Dioxide. Otto Sackur and E. Fritzmann (*Zeitsch. Elektrochem.*, 1909, **15**, 842—846).—The solubility of manganous hydroxide is measured by adding successive quantities of baryta solution to a solution of manganous sulphate and measuring the electrical conductivity of the solution after each addition. The whole operation is carried out in an atmosphere of hydrogen. The minimum conductivity is reached when the manganous sulphate is exactly precipitated, and the solution at this point is saturated with barium sulphate and manganous hydroxide. By subtracting the known conductivity of a saturated barium sulphate solution, that of a saturated solution of manganous hydroxide is obtained, and from this its solubility is found to be $2{\cdot}15 \times 10^{-5}$ gram-mol. per litre at 18°. From this determination (assuming that manganous oxide has the same solubility as the hydroxide), the *E.M.F.* of the galvanic cell oxygen at 1 atmosphere | saturated solution of MnO | MnO_2 | Pt, in which the reaction is $O_2 + 2MnO = 2MnO_2$, is calculated by means of this determination and Haehnel's determination of the normal potential of manganese dioxide (preceding abstract) to be 0·32 volt, from which the dissociation pressure of manganese dioxide at 18° is $6{\cdot}3 \times 10^{-23}$ atmosphere. Putting this value into Nernst's approximate formula: $\log p = -Q/2{\cdot}3RT + 1{\cdot}75 \log T + 3$, the heat of the above reaction is calculated to be 39,200 cals., which agrees moderately with Thomsen's value (for the hydrated oxides) of 43,000 cals. T. E.

Kinetics of Rapid Chemical and Ionic Reactions Investigated by the Oscillograph. D. Reichinstein (*Zeitsch. Elektrochem.*, 1909, **15**, 734—740).—If silver, immersed in a solution containing cyanion, is polarised anodically, two reactions can occur: first, silver ions will be formed, and then they will react with cyanion, thus: $Ag^{\cdot} + 2CN' = Ag(CN)_2'$. The concentration of the silver ions at the surface of the electrode, therefore, will increase until the velocity of the second reaction is equal to that of the first. If a cell is built up of the polarised electrode and a silver plate immersed in a solution of silver nitrate, its *E.M.F.* will be a known function of the concentration of the silver ions at the surface of the polarised electrode. Further, the rate at which the polarisation disappears when the current ceases to flow depends on the rate of reaction between silver ion and cyanion, supposing that the reaction is so fast that diffusion does not influence the change appreciably. The author has developed the mathematical expressions of these ideas, and has also photographed the curves of increase and decay of polarisation of copper and silver electrodes in cyanide solutions. The oscillograph used unfortunately required a rather large current, which made it impossible to compare the results quantitatively with the theoretical equations. The curves were, however, of the form expected. In similar circumstances, the polarisation of a copper electrode (in 4*N*-potassium cyanide) disappeared in 0·014 second, whilst with silver 0·005 second sufficed. T. E.

Absorption of Gases by the Anode in Glow Discharge. V. L. Chrisler (*Physikal. Zeitsch.*, 1909, 10, 745—752).—The author has investigated the absorption of hydrogen, nitrogen, and helium by various metallic anodes during glow discharge. Hydrogen is absorbed by anodes of silver, sodium, potassium, sodium-potassium alloy, and mercury, and the relationship between the rate of absorption and the discharge current indicates that each atom of hydrogen is accompanied by an electron. Nitrogen behaves quantitatively the same towards anodes of sodium, potassium, and sodium-potassium alloy.

In the majority of the experiments with helium, no absorption was observed, but in two experiments with a sodium anode and in two others with a mercury anode, helium was absorbed at a rate which indicated that each helium atom carried the same negative charge as the hydrogen and nitrogen atoms. H. M. D.

Electromotive Behaviour of Thallium as Anode. I. Wolf J. Müller (*Zeitsch. physikal. Chem.*, 1909, 69, 460—481).—The phenomena occurring during the anodic polarisation of thallium electrodes in solutions of sodium hydroxide, sulphuric acid, and sodium sulphate have been examined. A cell was constructed with a platinum cathode, the external *E.M.F.* on the electrodes was progressively increased, and the strength of the current and the difference of potential between the anode and the solution observed for each value of the applied *E.M.F.* The results are given in tabular form, and are also represented graphically. The values of the *E.M.F.* are referred to the *N*/10-calomel electrode throughout.

In *N*/10-sodium hydroxide, the current increases regularly with the polarisation, and thallium dissolves in the univalent form up to an applied *E.M.F.* of 10 volts. The behaviour of the anode in *N*-sodium hydroxide is much more complicated. There are three points on the polarisation-strength of current curve at which the polarisation remains practically constant with increased current, the first, at −0·7 volt, represents the dissolution of thallium in the univalent form; the second, at ±0 volt, probably represents the dissolution in the bivalent form; the third, at +1·1 volt, has not been fully investigated. When the polarised oxidised electrode is allowed to discharge, halts are observed at – 0·3 and – 0·6 volt.

When the applied *E.M.F.* in *N*/10-sulphuric acid is gradually raised, a point is reached at which the current remains practically constant on further increasing the *E.M.F.*, and pulsations occur. The current in these circumstances is proportional to the surface of the electrode, and stirring increases it considerably. The explanation advanced is that thallous sulphate forms on the anode, and give rise to a considerable resistance, but as it diffuses away, it allows the current to pass. Stirring naturally accelerates the diffusion of the salt, and thus increases the current. In both *N*- and *N*/10-sulphuric acid with larger applied *E.M.F.*, abnormal polarisation occurs. In the former solution, yellow crystals are formed on the anode, which probably represent a mixture of thallous and thallic sulphate. Complicated phenomena also occur when sodium sulphate is used as electrolyte.

The phenomena at the higher values of polarisation are discussed from the point of view of passivity, and, on the basis of the electron theory of passivity, the law is deduced that the influence of an anion in rendering an anode passive is inversely proportional to the solubility of the resulting compound in the surface layer. G. S.

Electromotive Behaviour of Oxygen. Fritz Foerster (*Zeitsch. physikal. Chem.*, 1909, 69, 236—271).—When a platinised platinum electrode is anodically polarised with oxygen up to a high potential, and is then removed from the polarising solution and placed in fresh sulphuric acid through which a stream of oxygen is passed, the potential falls steadily, in the course of some days, to 1·08 volts (measured against a hydrogen electrode in the same electrolyte) and shows no noticeable halts at intermediate points. When a platinum electrode covered with finally-divided iridium is subjected to the same treatment, the potential falls steadily, and more rapidly than when platinised platinum is used, to 0·86 volt; there is no halt at 1·06 volts, the potential of the hydrogen–oxygen cell with iridium electrodes. In explanation of this behaviour, it is suggested that labile peroxides are formed on charging the electrodes, these peroxides forming solid solutions with the finely-divided metals. The peroxides gradually decompose, giving up oxygen and forming more stable lower oxides, and it is this slow decomposition which determines the steady fall of potential. The platinum peroxide is more stable than the iridium peroxide, corresponding with the more gradual fall of potential in the former case.

The formation and decomposition of these oxides also explains the behaviour of anodes towards hydrogen peroxide and ozone. When hydrogen peroxide is added to a solution containing an electrode polarised with oxygen, the potential falls rapidly, owing to the interaction of the platinum peroxide with hydrogen peroxide with production of free oxygen and a consequent diminution in the platinum peroxide concentration. If, on the other hand, the electrode is only slightly polarised, hydrogen peroxide increases the platinum peroxide concentration and raises the potential. A similar explanation holds for the action of ozone. The observed potentials are therefore not true equilibria, but depend on the rate at which the platinum peroxide is formed and decomposed.

It is well known that oxygen is given off at a platinised platinum anode at a lower potential than at a smooth platinum surface. It is now shown, however, that with small currents at high temperature the oxygen is given off at a smooth platinum electrode at the low potential observed for the platinised platinum electrode, but the potential soon rises to the higher value. A similar behaviour is observed with smooth iridium electrodes, except that in this case the oxygen continues to come off at the low potential. This phenomenon is also accounted for on the theory of a peroxide formation; it is suggested that the anodes which have reached the high potential are saturated with the peroxide, and superficially covered with it. The fact that the low potential is more persistent in the case of iridium is due to the greater instability of the iridium peroxide. G. S.

Liberation of Oxygen during the Electrolysis of Hydrochloric Acid with a Platinum Anode. Georg Pfleiderer (*Zeitsch. physikal. Chem.*, 1909, 68, 49—82).—When a dilute solution of hydrochloric acid is electrolysed with a fresh platinum anode, and the current is kept constant, the potential rises gradually from about 1·4 to about 1·9 volts, and it is only at the last-mentioned potential that oxygen is given off freely. This phenomenon is doubtless connected with the gradual formation of a layer of platinum oxide on the anode (compare Foerster, preceding abstract). The oxidation of the platinum may be due to the influence of hypochlorous acid, formed by the action of chlorine on water.

Both oxygen and chlorine are formed when a dilute solution of hydrochloric acid is electrolysed, and the relative amounts of these gases liberated under varying conditions have been measured. With constant condition of the electrode and electrolyte, the relationship between the proportion of current, i_2, employed in liberating oxygen and that used up for other purposes is represented by the equation: $\log i_2 = a \log i_1 + b$, where a and b are constants depending on the condition of the electrode and the nature of the electrolyte. Further, the dependence of the oxygen given off on the concentration of hydrochloric acid is represented, between 0·10 and 1·5N by the equation: $b = b_0 + 2\log c$, where c represents the concentration. A theoretical explanation of these results is given, depending on the occurrence of supertension at the electrode.

The formation of oxygen in the electrolysis of hydrochloric acid might be looked upon as a secondary phenomenon due to the action of chlorine on water, represented by the equation: $2Cl_2 + 2H_2O = 4HCl + O_2$ (the "Deacon process"), this reaction being accelerated at the anode as the result of a chemical or electrochemical catalysis. The fact that a change in the rate of stirring has little influence on the proportion of oxygen formed, appears to show that the catalysis is not purely chemical. In any case, the proportion of oxygen given off is smaller than corresponds with the equilibrium of the Deacon process, but there is evidence that immediately after the discharge the concentration of oxygen is not less, and may be greater, than that corresponding with the equilibrium. The alteration in the relative proportions in the gas given off is due to the very different velocity with which the two discharge products change to the ordinary gaseous condition.

G. S.

Phenomena of the Electrolytic Decomposition of Hydrochloric Acid. Frank A. Gooch and F. L. Gates (*Amer. J. Sci.*, 1909, [iv], 28, 435—446; *Zeitsch. anorg. Chem.*, 1909, 64, 273—286).—Doumer (Abstr., 1908, ii, 252, 349, 458) has claimed that the ratio of the volumes of oxygen and hydrogen evolved in the electrolysis of hydrochloric acid is constant and independent of the strength of the current and concentration of the solution, and uses his results to show that the velocities of the hydrions and chloridions are equal. In order to test Doumer's results, the authors have further studied the electrolysis of hydrochloric acid under various conditions. The apparatus used was on the principle of a Hofmann voltameter; it was provided with a leveller, so that gas measurements could be made directly under atmospheric pressure. In every case the cathode was of platinum, but the material of the anode varied.

In the first set of experiments the anodes were of silver, and their area varied from 1 to 21·4 sq. cm.; the hydrochloric acid was either $N/50$ or $N/100$, and the current strength varied from 0·05 to 0·085 ampere. Oxygen was liberated only when the silver surface open to attack was small, and in no case attained the proportion (0·332 of the hydrogen) noted by Doumer. As long as the anode exposes a large silver surface, both oxygen and chlorine attack it. Silver chloride once attached may remain fixed on the anode, but silver oxide is subject to the action of the hydrochloric acid as well as to that of the liberated chlorine; colloidal silver chloride may be formed during these latter reactions (compare Noyes and Sammet, Abstr., 1903, ii, 126).

In the next set of experiments, the anode was made by dipping a piece of silver wire of 2·27 mm. diameter and 4 cm. long in fused silver chloride, and then using it as anode in a preliminary electrolysis of fairly concentrated hydrochloric acid until chlorine was freely evolved. In the actual experiments, the currents used were 0·05, 0·10, and 0·15 ampere, and the concentrations of hydrochloric acid were 0·43, 0·86, and 4·3 parts per 1000. The ratio of oxygen to hydrogen was found to increase markedly as the concentration of the solution decreased, although it was not materially affected by variations in the current strength or in the potential across the electrodes. Doumer's ratio was only attained with the lowest concentration of acid. When the protected silver anode was replaced by a spiral of platinum wire (area, 1·25 sq. cm.), the ratios of the volumes of oxygen to hydrogen were very little less for the two lower concentrations of acid, but much lower for the higher concentration.

In another series of experiments, the concentration of the acid was 0·043 part per 1000, and the anode (platinum) area 1·25 sq. cm.; the current varied from 0·07 to 1·0 ampere. The ratio of oxygen to hydrogen was fairly constant (= 0·44) throughout the entire period of electrolysis, and higher by about 30% than Doumer's ratio. Other experiments with platinum anodes of varying area and with acids of different concentrations confirmed the result that the proportion of oxygen liberated increases as the concentration of the solution decreases. The highest ratio (0·477) of oxygen to hydrogen was found at a concentration of 0·0086 part per 1000 and at a high current density (3·12 amperes per sq. dcm.), and is within 5% of what it would be were water the primary and sole electrolyte.

The observed phenomena afford no criterion for deciding how much of the oxygen liberated in the electrolysis of hydrochloric acid is transferred through the liquid and how much is evolved by the action of transferred chlorine at the anode. T. S. P.

Theoretical Considerations on the Electrolytic Dissociation of Dissolved Electrolytes. JOHANNES J. VAN LAAR (*Zeitsch. physikal. Chem.*, 1909, **69**, 433—435).—Reference is made to the author's views on solution (*Archives Teylsr*, 1908, ii, 235). G. S.

Molecular-theoretical Considerations regarding Electrolytic Dissociation. GIACOMO L. CIAMICIAN (*Zeitsch. physikal. Chem.*, 1909, **69**, 96—101).—The author shows that the view first suggested by him (Abstr., 1891, 390), that association between solvent and solute precedes electrolytic dissociation, is now meeting with wide acceptance. G. S.

Hydrolytic and Electrolytic Dissociation of Aluminium Bromide in Aqueous Solution. IWAN KABLUKOFF and AL. SACHANOFF (*Zeitsch. physikal. Chem.*, 1909, **69**, 419—432).—Solutions of aluminium bromide have a relatively high electrical conductivity; the values at 25° are somewhat greater than those for sodium bromide under equivalent conditions. As later measurements showed that the salt is not greatly hydrolysed in moderate dilution, the high conductivity must depend on electrolytic dissociation. This is confirmed by determinations of the Br′-ion concentration by measurements of the *E.M.F.* of concentration cells; when the dilution is about 20 litres per gram-equivalent, two-thirds of the bromine is electrolytically dissociated. The main ionic equilibrium in solution is probably represented by the equation: $AlBr_3 \rightleftharpoons AlBr^{\cdot\cdot} + 2Br'$.

The degree of hydrolysis of solutions of aluminium bromide has been determined by measuring the H˙-ion concentration from the results of *E.M.F.* measurements. Between $v=0·5$ and $v=5$ litres the degree of hydrolysis is almost independent of dilution; above $v=5$ it increases regularly with dilution. When $v=1000$ litres, the degree of hydrolysis is only about 4%. The main hydrolytic equilibrium is probably represented by the equation: $AlBr^{\cdot\cdot} + HOH \rightleftharpoons AlOH^{\cdot\cdot} + H^{\cdot} + Br'$. Neutral salts diminish the degree of hydrolysis slightly, and potassium bromide and nitrate exert about the same effect under equivalent conditions. G. S.

Anomaly of Strong Electrolytes and the Limits within which the Dilution Law is Valid. RUDOLF WEGSCHEIDER (*Zeitsch. physikal. Chem.*, 1909, **69**, 603—629).—The fact that the dilution law does not hold for strong electrolytes is connected with the high concentrations of ions in concentrated solutions of such electrolytes. The author has calculated in detail for the different groups of electrolytes, namely, organic acids and bases, inorganic acids and salts, the limits within which the dilution law is applicable, and draws the conclusion that, in the absence of complex formation, etc., the law in question is approximately valid for all binary electrolytes with univalent ions up to an ionic concentration of about 0·03 mol. per litre; in stronger solutions deviations from the simple law occur. In arriving at this conclusion, however, some rather uncertain assumptions are made, more particularly with reference to the values of μ_∞ for inorganic salts. G. S.

Theory of the Direct Method of Determining Transport Numbers. W. Lash Miller (*Zeitsch. physikal. Chem.*, 1909, 69, 436—441).—It is shown theoretically, by a method involving no assumptions as to rates, mobilities, currents, or constitution of the ions, that transport numbers calculated from observations of the motion of the meniscus must be identical with those obtained by the ordinary analytical method of Hittorf. G. S.

Thermal Conductivity of Air and other Gases. George W. Todd (*Proc. Roy. Soc.*, 1909, *A*, 83, 19—39).—An improved method of measuring the thermal conductivity of gases is described. The gas is enclosed between two parallel metal plates, the upper one of which forms the base of a steam chamber, and the lower one the top of a chamber through which cold water is circulated. To ensure thorough circulation, the interior of the cold chamber is divided up by means of a series of partitions parallel to the plate forming the roof of the chamber. The space between the hot and cold plates is cut off from the exterior by means of a ring of insulating material, and for comparative observations with gases other than air, the chamber is sealed by painting round the edges of the plates and ring with shellac varnish.

The rate at which heat passes through the lower plate is measured by observation of the rise in temperature of water, which is made to flow at a uniform and measured rate through the cold calorimeter chamber. In the case of air, observations were made with the hot and cold plates separated by distances varying from about 0·1 to 0·7 cm., and from the series thus obtained the radiation effect can be eliminated.

The values obtained for the thermal conductivity at the mean temperature of 55° are: air 0·0000571, carbon dioxide 0·0000111, oxygen 0·0000593, nitrogen 0·0000569, nitric oxide 0·0000539, nitrogen peroxide 0·0000888. H. M. D.

Specific Heats of Silicates and of Platinum. Walter P. White (*Amer. J. Sci.*, 1909, [iv], 28, 334—346).—For determining the specific heats of silicates up to 1500° the method of mixtures was used, in which the heated substance and containing crucible are dropped from a furnace into a calorimeter at room temperature. A special form of electric furnace was used in order to diminish the lack of uniformity in the furnace temperature, this ordinarily being one of the chief sources of error, and an electrical method of releasing the crucible was devised to reduce the time required in transferring it from the furnace to the calorimeter. All temperatures, including that of the calorimeter, were read by thermo-elements. The calorimeter was completely enclosed by a water-jacket, except just at the moment when the crucible was dropped in, and an unusually large temperature rise (sometimes 23°) was employed to increase the accuracy.

A table of mean specific heats, from zero, of eight substances, including quartz, is given, and also the following table of true specific heats.

Temp.	Platinum.	Wollastonite.	Pseudo-wollastonite.	Orthoclase.	Diopside.	Orthoclase glass.	Soft tubing glass.
500°	0·0356	0·251	0·250	0·257	0·262	0·264	0·298
700	0·0368	0·263	—	—	0·272	—	0·324
800	—	—	—	0·272	—	0·282	—
900	0·0380	0·262	—	—	0·281	—	0·340
1100	0·0390	0·261	0·259	0·279	0·286	0·297	0·335
1300	0·0400	—	0·257	—	0·278	—	0·333
1500	0·0407	—	—	—	—	—	0·332

The mean specific heats are accurate to less than 0·5% at most temperatures; the true specific heats are not so accurate. The specific heats of silicates show a considerable increase with temperature up to 700°, followed by a tendency to diminish at higher temperatures.

The mean specific heats of platinum and of diopside are expressed by the following formulæ: Platinum, $0{\cdot}03198 + 3{\cdot}4 \times 10^{-6}t$; diopside, $0{\cdot}1779 + 1{\cdot}516 \times 10^{-4}t - 1{\cdot}047 \times 10^{-7}t^2 + 2{\cdot}81 \times 10^{-11}t^3$, where t is the temperature. T. S. P.

Specific Heats of Mixtures of Saturated Alcohols and Water. II. ANTONY G. DOROSCHEWSKY (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 958—977).—Measurements of the specific heats of aqueous solutions of methyl, propyl, *iso*propyl, and *iso*butyl alcohols, of various concentrations and at different temperatures, show that these mixtures exhibit the peculiarity observed with mixtures of ethyl alcohol and water (Abstr., 1908, ii, 807; compare also Bose, Abstr., 1907, ii, 332, 333), the specific heats of all the solutions being greater than the values calculated from their compositions, and those of dilute solutions greater than the specific heat of water. The specific heats of these mixtures for the temperature-interval 18—100° exhibit maxima for 10% solutions in the case of methyl and propyl alcohols, and for 20% solutions with ethyl and *iso*propyl alcohols. A maximum specific heat is evidently exhibited by all solutions for which a great difference exists between the composition of the vapour and that of the boiling (at 760 mm.) liquid.

Aqueous solutions of *iso*butyl alcohol containing from 100% to 83·63% or from 0% to 4·66% of the alcohol, that is, those solutions which remain homogeneous when heated from 18° to 100°, have specific heats greater than the calculated values, but less than that of water; a maximum specific heat was not observed with these solutions. Solutions containing 7—8% of the alcohol, which separate into layers and subsequently mix again when heated from 18° to 100°, show a marked rise in specific heat. Such rise is observed also with a solution containing 6·76% of *iso*butyl alcohol, although no separation into layers and re-dissolution occur; here, too, the cause of this phenomenon lies doubtless in a certain, although not an evident, separation of the two liquids. An analogy probably exists between the separation into layers and the specific heat of *iso*butyl alcohol solutions, on the one hand, and the vaporisation and specific heat of the lower alcohols, on the other. T. H. P.

Specific Heats of Solutions of Salts in Water and Alcohol. Antony G. Doroschewsky and Adam W. Rakowski (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 1110—1116).—For the calculation of the specific heats of solutions, the following two formulæ, both representing straight lines, have been employed: (1) $S_1 = S_0 - (S_0 - \sigma)m/100$, and (2) the more simple form, $S_1 = S_0 - S_0m/100$, where S_1, S_0, and σ are the specific heats of solution, solvent, and solute respectively, and m is the weight of solute per 100 grams of solution. The authors have investigated the following cases:

(1) Aqueous solutions of cadmium iodide.—Here the specific heat follows the above formulæ neither quantitatively nor qualitatively, the curve connecting percentage of salt present and specific heat being not a straight line, but a complex curve exhibiting a bend. For solutions containing up to about 20% of cadmium iodide, the curve lies below, and for more concentrated solutions above, the straight line represented by formula (2). So that here, as in many other cases, the specific heat of the solutions is less than that of the water they contain; the solutions behave, indeed, like the solvent does under great pressure.

(2) Solutions of cadmium iodide in absolute ethyl alcohol.—For these solutions, the specific heats lie on a straight line, but are, in all cases, greater than the calculated values.

(3) Five per cent. solutions of mercuric chloride in aqueous alcoholic mixtures, varying in concentration from 0 to 100%.—When the solvent contains less than about 15% of alcohol, the curve connecting specific heats of the solutions with the percentages of salt present approximates to the typical curve for aqueous solutions, whilst for solvents containing more than 15% of alcohol, the curve is similar to those for alcoholic solutions. T. H. P.

Forms of the Partial and Total Vapour Pressure Curves of Binary Mixtures. Jan van Zawidzki (*Zeitsch. physikal. Chem.*, 1909, 69, 630—662).—A theoretical paper. The possible forms of the partial and total vapour pressure curves of binary mixtures are deduced from the integrals of the well-known Duhem-Margules equation. The partial pressures are expressed as fractions of the pressures of the pure components, the so-called "reduced" partial pressures, and it is then shown that the reduced partial pressure curves can be divided into symmetrical and unsymmetrical, and each of these again into a number of forms. The total pressure curves are dealt with in a similar way.

These conclusions are illustrated by choosing different relative values of the factors in the integrals, and determining the influence on tho forms of the curves; the results are also illustrated graphically. It is probable that alterations of temperature have only a slight influence on the forms of the reduced partial pressure curves. G. S.

Vacuum Distillation and the Effect of Gravity on the Boiling Point. FRIEDRICH KRAFFT (*J. pr. Chem.*, 1909, [ii], 80, 242—261).—Polemical against von Rechenberg (this vol., ii, 544). The author points out that von Rechenberg has overlooked much of his work on distillation in the cathode light vacuum, and shows that the criticisms of the latter chemist are not justified. The influence of the weight of the column of vapour on the boiling point in a vacuum has already been discussed, and it has been shown that in these circumstances the boiling point is a function of the molecular weight (Abstr., 1908, i, 1). G. S.

Effect of Gravity on the Boiling Point. Determination of the Boiling Point under the Ordinary Pressure. FRIEDRICH KRAFFT (*J. pr. Chem.*, 1909, [ii], 80, 469—472. Compare preceding abstract).—Gravity is shown to exert a measurable influence on the boiling point of a liquid. The b. p. of *p*-xylene under a pressure of 757 mm. is found to be about 0·038° higher at Gothenberg (58° *N. Lat.*) and about 0·015° higher at Bremen (53° *N. Lat.*) than at Heidelberg (49·5° *N. Lat.*), whilst ethylene bromide under constant pressure boils about 0·016° higher at Bremen than at Heidelberg. W. H. G.

A Source of Error but little Considered in the Determination of Boiling Points under Diminished Pressure. CHRISTIAN JOHANNES HANSEN (*J. pr. Chem.*, 1909, [ii], 80, 449—455).—Polemical against von Rechenberg (compare this vol., ii, 544). W. H. G.

Certain Relations between Boiling Points. JOHN C. EARL (*Chem. News*, 1909, 100, 245).—The replacement of one atom of chlorine by one atom of bromine in a large number of organic substances raises the boiling point by about 23—24°. The difference in boiling point between XBr_2 and XCl_2 is about 48° ($= 2 \times 24°$), and between YBr_3 and YCl_3 about 72° ($= 3 \times 24°$). Iodine and bromine show similar relations.

The difference between the boiling points of chlorine and bromine, 92·4° ($= 4 \times 23·1°$), suggests that these elements at their boiling points are Cl_4 and Br_4. R. J. C.

Efficiency of Fractional Distillation by Heat Generated Electrically. THEODORE W. RICHARDS and J. HOWARD MATHEWS (*J. Amer. Chem. Soc.*, 1909, 31, 1200—1202).—In the previous paper (Abstr., 1908, ii, 828) a method was described for use in fractionating organic liquids depending on the use of a coil of platinum wire heated by an electric current.

Further experiments have now been carried out, and have shown that, whilst a somewhat better separation is effected by the electrical heating than by the ordinary method, and much less superheating is produced, the gain in the efficiency of separation is not in all cases as great as was at first supposed. E. G.

Determination of Melting Points. WALTER P. WHITE (*Amer. J. Sci.*, 1909, [iv], 28, 453—473).—The author discusses the principal causes of oblique melting curves, giving a mathematical treatment of the same. Actual melting and freezing-point curves are nearly always oblique. The prime cause of obliquity in melting curves is the obliquity of the melting itself, due to impurity. The true melting point is the high end of the oblique melting interval. The melting hysteresis of some very viscous substances (mostly compounds of boron and silicon) is also an occasional (and then serious) cause of obliquity.

The determination of a melting curve necessarily involves two factors: temperature rise and heat supply. The latter depends on the temperature difference between the furnace and the charge being melted; if this varies, the curve is considerably distorted, but corrections are easily applied. The most common example is where the furnace temperature is allowed to rise or fall continuously, whilst that of the substance remains nearly stationary during the process of melting or freezing.

The freezing point is easier to observe than the melting point, since it occurs at the beginning of the interval where temperature distribution in the charge is relatively uniform; it is, however, inadmissible in substances where undercooling is marked. The melting point, coming at the end (in time) of the interval, is liable, where stirring is not practised, to obliquities resulting from uneven temperature distribution: (1) Due to the inevitable temperature difference between the inside and outside of the charge; this is troublesome with large charges, but negligible with small. (2) Due to various irregularities in heat flow; these are least with narrow charges and small thermo-elements. (3) Due to the conduction of heat down the thermo-element; this is usually negligible for narrow charges and small thermo-elements, but it may amount to several degrees with enclosed elements.

Electrical conductivity in the fusion produces an error in the reading of bare thermo-elements; this is negligible for small charges. Contaminated elements, besides reading false, read so as to increase obliquity. The obliquity is also increased by differentiation and diathermancy of the charge.

Melting points have been determined above 800° agreeing with each other to 0·05°. In most cases an experimental obliquity remains of 0·5—1·5° (at high temperatures), the cause of which is still to be definitely determined.

The following melting points are given: sodium chloride, 801° ± 1°; sodium sulphate, 885° ± 1°. T. S. P.

Melting-Point Methods at High Temperatures. WALTER P. WHITE (*Amer. J. Sci.*, 1909, [iv], 28, 474—489).—The author discusses the apparatus and procedure necessary to determine melting curves, according as the main object is the accurate location of heat absorptions, their quantitative measurement, or their mere detection when obscure.

Platinum-resistance furnaces of simple construction provide complete control of the temperature for melting-point work up to 1600°. Where uniformity of temperature throughout the working-chamber is important, special modifications are necessary. Small charges (2·5 grams) give very sharp melting points, are economical of material, and permit of convenient manipulation.

A number of advantages result from the use of a second thermo-element, which records the furnace temperature about the charge. The measurement and regulation of the heat supply from the furnace is a factor of great importance in accurate melting-point determinations.

Methods of treating and insulating thermo-elements and of avoiding the effects of contamination are described.

The melting points of very viscous substances, showing hysteresis, can be determined easily and effectively by very slow heating and occasional examination outside the furnace.

The approximate determination of latent heats of fusion directly from melting curves is possible by measurement of the furnace temperature, but there are several hitherto undetermined sources of error. The attainment of an accuracy greater than 10% (about 10 calories in many silicates) accordingly requires special apparatus and procedure. The smaller latent heats of inversion can usually be determined to one or two calories with no other apparatus than the two thermo-elements.

For determining faint or sluggish thermal effects, rapid rates of heating and the utmost precision in furnace regulation and temperature measurement is needed.

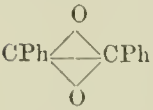
The accurate location of eutectics by thermal means requires the detection of small residues of the component in excess. This can be accomplished by a special method involving the use of a neutral substance. T. S. P.

Retrogressive Melting-point Lines. ANDREAS SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 227—230).—From an examination of van der Waals' equation for melting-point curves, the author draws the conclusion that if a hydrate loses much water at its transition point, a retrograde solubility curve may be expected, for it is probable that the change in the heat of melting is less than that in the heat of mixing.

To explain the retrograde solubility curve of rhombic sodium sulphate, it seems necessary to assume a retrogression of the hydration in solution with rising temperature. The strongly retrogressive character of the solubility curve of monoclinic sodium sulphate as compared with that of the curve for the rhombic salt indicates that the latent heat of liquefaction of the former is much smaller than that of the latter. H. M. D.

Melting-point Curves of Endothermic Compounds. A. H. W. ATEN (*Zeitsch. physikal. Chem.*, 1909, 68, 39—42).—As bismuth trichloride and pentachloride unite to form the endothermic compound $SbCl_4$, it seemed possible that antimony trichloride and pentachloride might combine to form the componnd $SbCl_4$. The melting-point curve of the latter system shows a eutectic point about 2·5° (m. p. of antimony pentachloride, 4°), the eutectic mixture containing about 3% of antimony pentachloride, and from this point rises fairly steeply to the melting point of antimony trichloride, although between 30 and 80 mol. % of the trichloride the curve is rather less steep. This form of curve does not correspond definitely with any of the three possible forms of curve for a binary system in which an endothermic compound is formed, and therefore the melting-point curve affords no evidence of the existence of the compound $SbCl_4$. G. S.

_cyclo_Hexane as a Cryoscopic Solvent: Cryoscopic and Ebullioscopic Behaviour of Ketones Dissolved in _cyclo_Hexane. LUIGI MASCARELLI and I. MUSATTY (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 195—202. Compare this vol., ii, 790).—The authors have examined the cryoscopic and ebullioscopic behaviour of solutions in *cyclo*hexane of a number of ketonic compounds (compare this vol., ii, 19), all of which have molecular weights higher than the theoretical values in the freezing solvent. Benzil is not soluble in the cold, but in boiling *cyclo*hexane it has the normal molecular weight, being probably transformed, owing to the proximity of the two ketonic groups, into the form represented by the annexed formula (*loc. cit.*). The results indicate that where a ketone is able to form an enolic modification, the latter is produced and undergoes association in *cyclo*hexane solutions. T. H. P.



_cyclo_Hexane as a Cryoscopic Solvent. Behaviour of _cyclo_Hexanone Dissolved in _cyclo_Hexane. LUIGI MASCARELLI and I. MUSATTY (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 253—258).—Fresh results have been obtained which, in conjunction with those already published (preceding abstract), indicate that the anomalous cryoscopic behaviour of *cyclo*hexanone in *cyclo*hexane is due to three causes: (1) association occasioned by the presence of the carbonyl group; (2) association owing to the formation of a hydroxy-compound by tautomeric change; (3) formation of solid solutions between solvent and solute. T. H. P.

Cryoscopy of Neutralisation of Certain Acids. E. CORNEC (*Compt. rend.*, 1909, **149**, 676—678).—The curves representing the variation of freezing-point lowering with composition in mixtures in all proportions of equivalent solutions of acids and bases show sharp minima where sharply defined salts are produced, and bends where partly stable compounds are present.

Thus, on successively adding quantities of $0{\cdot}5M$-sodium hydroxide to $0{\cdot}5M$-hydrogen chloride, the freezing-point lowering falls regularly from 1·885° to 0·890° when equivalent proportions are present, and then rises regularly to 1·705°, the value given by the pure sodium hydroxide solution. The graph consists of two practically straight lines, showing that only one compound, sodium chloride, is produced.

Sodium sulphate gives a well-defined minimum, but there is no evidence of the existence in solution of $NaHSO_4$, which appears to be resolved into a mixture of free acid and normal salt.

Arsenic acid gives a minimum for Na_3AsO_4, and two folds representing the partial formation of NaH_2AsO_4 and Na_2HAsO_4.

Acetic acid behaves like hydrochloric acid; citric and phosphoric acids resemble arsenic acid; also, with oxalic acid a fold represents the acid salt, whereas the normal salt gives a sharp minimum.

Phosphorous acid, H_3PO_3, behaves like the dibasic oxalic acid, giving a minimum at Na_2HPO_3. There is no indication of a normal phosphite, Na_3PO_3. Hypophosphorous acid, H_3PO_2, behaves as a monobasic acid. These facts are in accordance with what is known of the solid phosphites and hypophosphites.

When ammonia is used instead of sodium hydroxide, the results obtained with all the above-mentioned acids are the same, except that the normal phosphates and arsenates of ammonia are not formed, minima being observed at the compositions: $(NH_4)_2HPO_4$ and $(NH_4)_2HAsO_4$ instead.

The indications of the electrical conductivity method are often at variance with the author's conclusions. It is pointed out that conductivity is a complicated function of the number of ions and their mobility, whereas the freezing point, which depends only on the number of molecular units, is preferable, and affords evidence in agreement with chemical evidence. R. J. C.

Condition of Substances in Absolute Sulphuric Acid. ARTHUR HANTZSCH (*Zeitsch. physikal. Chem.*, 1909, **68**, 204—213).—A reply to Oddo and Scandola (this vol., ii, 377), in which the author maintains the accuracy of his freezing-point measurements. In support of this it is shown that when molecular weight values are calculated for solutions containing the hydrogen sulphates of potassium, sodium, ammonium, pyridine, quinoline, and acridine from the successive freezing-point differences, the numbers obtained from the author's data are much more nearly constant than those obtained from the data of Oddo and Scandola. On account of the discrepancies inherent in the determinations of these observers, the data obtained by them cannot be used as an argument against the author's hydronium theory. H. M. D.

New Thermo-regulator for Use with Gas. PAUL POETSCHKE (*J. Amer. Chem. Soc.*, 1909, **31**, 1218—1219).—The apparatus consists of a large cylindrical bulb filled with air, which is placed in the incubator or oven required to be kept at a constant temperature, and is connected to the side-arm of a U-tube containing nearly sufficient mercury to reach the opening of the tube by which the gas is admitted; the latter tube is provided with a small hole in the side. The regulator operates in the same manner as the usual well-known forms. It has the advantage of great sensitiveness, and is easily manipulated and readily cleaned. It can be used in air-baths at temperatures even above the boiling point of mercury, but its sensi-

tiveness to changes of atmospheric pressure preclude its use in cases in which differences of a few hundredths of a degree are of importance.
E. G.

Simple Method for Determining Vapour Densities and for Analysing Binary Mixtures. Philip Blackman (*Chem. News*, 1909, 100, 174—175).—A summary of work already published (this vol., ii, 21, 298, 643).
G. S.

Easy Method for Determining Vapour Densities. Philip Blackman (*J. Physical Chem.*, 1909, 13, 606—608. Compare this vol., ii, 867).—An improved form of capillary tube and a filler for it are described.
R. J. C.

Critical Volumes and Density Curves of Solutions. Mieczyslaw Centnerszwer (*Zeitsch. physikal. Chem.*, 1909, 69, 81—89. Compare Abstr., 1908, ii, 13).—When a series of sealed tubes containing different amounts of a pure liquid in contact with its vapour are heated, it is observed that the temperature at which the boundary between the two phases disappears (the "limiting temperature") increases at first as the fraction of the tube filled with liquid is increased, reaches a maximum, and with further increase in the proportion of liquid, gradually falls. Thus, if the average density of the contents of the tube is plotted against the temperature at which the meniscus disappears, a parabolic curve is obtained, the maximum point of which corresponds with the critical temperature.

Corresponding observations have now been made for solutions of phenanthrene in methyl chloride, naphthalene in ethyl ether, and potassium iodide in methyl alcohol. For the first system, the curves obtained by plotting the densities as abscissæ against the limiting temperature as ordinates show no maxima; the maximum for the pure liquid has become a point of inflexion for solutions. It may, however, be expected that a maximum will be obtained for solutions when the two components do not differ greatly in volatility, and this is shown to be the case for solutions of naphthalene in ether. The density curve for this system shows a critical point at 196°, and a maximum at a rather higher temperature (the temperature of maximum condensation). On the other hand, the density-temperature curve for solutions of potassium iodide in methyl alcohol is extremely steep in the neighbourhood of the critical point for the pure liquid, corresponding with the great difference in the volatility of the components.

It was incidentally observed that potassium iodide is less soluble in methyl alcohol in the neighbourhood of the critical temperature than at ordinary temperatures, and as the temperature-coefficient in the neighbourhood of 25° is positive, there must be a maximum on the temperature-solubility curve.
G. S.

Propagation of "Shocks" in Fluids. Pierre Duhem (*Zeitsch. physikal. Chem.*, 1909, 69, 169—186).—A mathematical paper. The main conclusions are as follows. When a "shock" is propagated in a perfect gas, the speed of the wave, referred to the fluid behind, always exceeds in absolute value the speed of sound in the fluid in front; the speed of the shock, referred to the fluid in front, is inferior in absolute value to the speed of sound in the fluid in front as long as the density of the fluid in front is inferior to the product of the density of the fluid behind by $2C_v/(C_p - C_v)$; when the density of the fluid in front surpasses this limit, the speed of the shock referred to the fluid in front exceeds, in absolute value, the speed of sound in the fluid behind.

As the ratio of C_p, the specific heat of a gas at constant pressure, to C_v, the specific heat at constant volume, is about 1·4 for a perfect diatomic gas, the expression $2C_v/(C_p - C_v)$ above referred to is about 5.

G. S.

Internal Friction in the Critical Zone. Demetrius E Tsakalotos (*Zeitsch. physikal. Chem.*, 1909, 68, 32—38).—The viscosities of certain binary systems have been measured at temperatures very near the respective critical solution temperatures, but such that the systems were still homogeneous. With the system *iso*butyric acid and water (completely miscible above 23·5°), measurements were made at 26° and for certain mixtures at 22°. At both temperatures the viscosity curve shows a distinct maximum at 65% of the acid, and the viscosities are greater than that calculated by the mixture rule. The viscosity curve of mixtures of amylene and aniline (completely miscible above 14·4°) was determined at 20°; it is hyperbolic, and the viscosities are less than those calculated by the mixture rule.

The viscosity curve of the system triethylamine and water (completely miscible below 18·7°), measured at 15°, shows a distinct maximum, corresponding with a composition of about 48% by weight of triethylamine. The corresponding measurements with nicotine and water have already been published (compare this vol., i, 412).

The general course of the viscosity curves is therefore independent of the existence of the critical zone. The maxima on the curves appear to indicate combination between the two components of the binary mixture.

G. S.

Viscosity of Binary Mixtures at their Boiling Points. Alexander Findlay (*Zeitsch. physikal. Chem.*, 1909, 69, 202—217).—The viscosities of the following six binary mixtures, benzene and carbon tetrachloride, benzene and ethyl alcohol, acetone and chloroform, benzene and methyl alcohol, chloroform and ethyl alcohol, and carbon tetrachloride and ethyl alcohol, containing the components in varying proportions have been determined at temperatures just below those of the boiling points of the respective mixtures instead of at a single temperature, as has hitherto been usual. A slightly modified form of the Ostwald viscosimeter was used; it was adjusted to a temperature exactly 1° below the boiling point of the particular mixture under investigation, these boiling points being known from the work of previous observers. The densities of the mixtures were also determined at the temperatures in question.

The observed values of the viscosity are compared with those calculated according to the mixture law by means of the formula $1/\eta = v_1/\eta_1 + v_2/\eta_2$, where η_1 and η_2 refer to the viscosities of the components at the temperature of the experiment, and v_1 and v_2 are calculated from the density determinations. The results are given in tabular form, and the observed viscosity curves and those calculated according to the mixture law are represented graphically in order to show the deviations. Except in the cases of benzene and carbon tetrachloride and of chloroform and acetone, the observed values of the viscosity are lower than the calculated. The nature and even the extent of the deviations from the mixture law are approximately the same as when the viscosities are determined at a single temperature in those cases where comparison is possible. The author regards the position of maximum deviation between observed and calculated values of the viscosity as of more importance than the position of the points of maximum or minimum viscosity which are sometimes met with in viscosity curves of binary systems. G. S.

Surface Tension and Adsorption. Edgard Zunz (*Bull. Soc. chim. Belg.*, 1909, 23, 374—378).—Solutes which lower the surface tension of their solvent tend to accumulate at the surface, and the greater this surface tension effect the more easily the solute is adsorbed by an adjacent solid or liquid surface. When adsorption occurs, the increase of the surface tension is often a rough index of the amount of solute transferred from the solution, and the absence of adsorption is in many cases indicated when the surface tension remains unchanged.

The author has investigated the adsorption of diphtheric toxin and antitoxin, cobra venom, pepsin, enterokinase, and active and inactive pancreatic fluid by animal charcoal, kaolin, clay, talc, barium sulphate, and kieselguhr. There appears to be no relation between the adsorption of these substances and the comparatively insignificant changes in density, freezing point, and refractive index. The surface-tension phenomena are quite clear, although surface tension is apparently not the only factor in adsorption.

Animal charcoal adsorbs diphtheric toxin and antitoxin, but not the combination, toxin-antitoxin. Barium sulphate, talc, clay, kaolin, and wood-charcoal adsorb neither toxin, antitoxin, nor their combination.

Animal-charcoal, clay, kaolin, barium sulphate, and, to a slight extent, talc and wood-charcoal absorb the tetanic lysin and cobra venom, whereas kieselguhr is without effect. Antilysin and the combination, lysin-antilysin, are not adsorbed by any of the above substances.

The adsorptive power of a substance does not only depend on the area of surface it exposes, as Freundlich supposed, but also on its specific relation to the substance adsorbed. Of the two kinds of adsorption distinguished by Michaelis and Rona, namely, mechanical and electrochemical, the cases studied by the author are probably electrochemical.

It is suggested that when a toxin or a lysin is neutralised by its antisubstance, the latter is adsorbed by the serum proteins, and the toxin or lysin is subsequently adsorbed. When brought together in the same protein molecule, the toxin and antitoxin slowly combine together and forsake the protein molecule, the neutralisation becoming then an irreversible one. R. J. C.

Adsorption of Certain Bases by Soluble Starch. ALBERT REYCHLER (*Bull. Soc. chim. Belg.*, 1909, 23, 378—383. Compare Fouard, this vol., i, 699).—The experiments of Fouard on the precipitation of alkalis along with soluble starch by means of alcohol led him to the conclusion that no chemical combination of the alkali had occurred. The author shows, however, that Fouard's values are best explained on the hypothesis that compounds of alkali and starch are formed which are easily dissociated by water in accordance with the mass action law. It must be assumed that each equivalent of $C_6H_{10}O_5$ in the starch molecule exercises an equal attraction for the molecules of alkali: $C_6H_9O_4(OH) + KOH \rightleftharpoons H_2O + C_6H_9O_4(OK)$. Hence, if a, x, and 3·184 are the concentrations of total alkali, combined alkali, and $C_6H_{10}O_5$ expressed in milligram-molecules per litre, the concentration of the water being practically constant,

$$x/(a-x)(3{\cdot}184-x)$$

should be a constant.

A fair constant is actually obtained when a few of the experimental results, which do not fall on the experimental curves, are omitted. The mean constants are KOH 0·29, NH_4OH 0·014, and piperidine 0·0034.

Imperfectly solubilised starch has less affinity for alkalis, but obeys the same law, giving a constant 0·16 for KOH.

The chemical actions in question are not necessarily of the above type, but may be of the types $R=O + KOH \rightleftharpoons R(OK)(OH)$ or $R=O + NH_3 \rightleftharpoons H_2O + RNH$, the last recalling the formation of osamines from dextrose, maltose, etc. (Lobry de Bruyn, Abstr., 1895, i, 640). R. J. C.

Dissociation of Hydrogen Sulphide. GERHARD PREUNER and W. SCHUPP (*Zeitsch. physikal. Chem.*, 1909, 68, 157—168. Compare Abstr., 1907, ii, 861))—In the previous investigation of the dissociation of hydrogen sulphide, the results obtained were only in moderate agreement with the requirements of Nernst's equation connecting equilibrium constants and temperature. On this account new measurements have been made, partly by Loewenstein's method (Abstr., 1906, ii, 272), and partly by the use of a quartz spiral manometer of the type described by Abegg and Johnson (Abstr., 1908, ii, 157). The time required for the measurements according to the former method was greatly reduced by the use of a null manometer. By this means the equilibrium pressure could be obtained by observations on the rate of change of the pressure resulting from the diffusion of the hydrogen through the platinum diaphragm.

The results obtained by the two methods of investigation are in satisfactory agreement. The values of the dissociation constant $k = 2p^3/760(2A-3p)^2$, where A is the total gas pressure, and p the partial pressure of the dissociated hydrogen, are as follows:

750°	830°	945°	1065	1132°
0·89	3·8	24·5	118	260×10^{-4}

The mean value obtained for the heat of formation of hydrogen sulphide from the variation of the equilibrium constant with the temperature is 40,000 cal. (instead of 39,400 cal.); this, of course, refers to the formation from sulphur vapour. The new values of the dissociation constants agree fairly well with Nernst's equation.

H. M. D.

Hydrolysis of Sodium Borates. JOHN LUNDBERG (*Zeitsch. physikal. Chem.*, 1909, **69**, 442—448).—The OH'-ion concentration in solutions of borax and in other solutions prepared by adding to borax varying proportions of sodium hydroxide has been measured at 25° by observations of the rate at which ethyl acetate is hydrolysed in the solutions. All the solutions behave as if they represented mixtures of $NaBO_2$ and HBO_2 in varying proportions. The former is partly hydrolysed according to the equation $NaBO_2 + HOH \rightleftarrows NaOH + HBO_2$, and in $N/10$ solution at 25° the salt is hydrolysed to the extent of 1·38%. The equilibrium constant $k = [OH'][HBO_2]/[BO_2'] = 1{\cdot}90 \times 10^{-5}$, and it can easily be shown that the OH'-ion in a solution of borax is independent of the borax concentration. In a $N/10$-solution of borax, 0·019% of the salt is hydrolysed. From the above value of k, it is calculated that the dissociation constant of boric acid at 25° is $6{\cdot}4 \times 10^{-10}$, which is only in moderate agreement with the value obtained directly by Walker, $k_1 = 17 \times 10^{-10}$ at 18°.

G. S.

Diffusion of Electrolytes in Aqueous Solutions. B. LINO VANZETTI (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 229—234).—The author has made experiments, according to the method previously described (compare Abstr., 1908, ii, 20, 88), with the object of testing Nernst's theoretical formula for the coefficient of diffusibility of an electrolyte as a function of the osmotic pressure and of the velocities of migration of the single ions, $D = 2UV.RT/(U + V)$, U and V being proportional to the electrolytic mobilities of the component ions. Solutions of various concentrations of the chlorides, bromides, and iodides of hydrogen, sodium, potassium, rubidium, cæsium, and lithium were made to diffuse along the capillary tube of the apparatus towards solutions of silver nitrate of corresponding densities, the distances traversed by the alkali salts before precipitates were deposited in the tube being expressed as percentages of the total length of the tube.

The results obtained show that with increase of dilution of the solutions, the velocities of diffusion of the halogen salts and acids increase in comparison with that of the silver salt; this increase causes the values for the halogen hydracids to approach, and those for the salts to recede from, the values calculated by means of Nernst's formula. More especially with hydrogen chloride, the value for which surpasses the theoretical number, and with the chlorides, this behaviour is partly attributable to supersaturation phenomena; but the latter do not explain those cases in which, for the higher concentrations, the precipitate is formed nearer to the alkali salt solution than to the silver nitrate solution. It is hence necessary to suppose that some influence is exerted by the concentration, and the author suggests that the salts undergo hydrolysis, yielding small quantities of the corresponding acids, which outstrip the salts, the positions of the precipitates being those corresponding with the acids; this phenomena would become appreciable only at excessive dilutions. This hydrolytic dissociation, which probably takes place before the electrolytic dissociation is completed, is regarded as expressed, at the ordinary temperature, by the reversible equation:

$$HX + MOH \rightleftarrows MX + H_2O.$$

T. H. P.

Size of the Pores in Porcelain and Osmotic Effects. S. Lawrence Bigelow and F. E. Bartell (*J. Amer. Chem. Soc.*, 1909, **31**, 1194—1199).—Bigelow (Abstr., 1908, ii, 88) has shown that the passage of water through collodion, gold-beaters' skin, parchment paper, and unglazed porcelain conforms to the laws regulating the passage of liquids through capillary tubes, and it has therefore been considered probable that these membranes consist of networks of capillaries.

In order to determine the diameter of such capillary tubes, measurements have been made of the pressure required to force the water out of a porcelain membrane previously saturated with it, and from the data so obtained, the diameter of the pores has been calculated by the application of Jurin's law. Experiments have also been made to ascertain the conditions under which such membranes show osmotic effects. The method and apparatus employed are described with the aid of diagrams.

The results indicate that the maximum pore diameter for a distinct osmotic effect with porcelain is 0·37 micron, with porcelain clogged with barium sulphate, 0·59 micron, and with porcelain clogged with sulphur, 0·49 micron. These figures must only be regarded as approximations, and, from the fact that they are so nearly the same, it seems probable that the diameter of the capillary is the chief factor in determining the appearance of osmotic phenomena. E. G.

Capillary Ascension of Colouring Matters. Louis Pelet-Jolivet (*Arch. Sci. phys. Nat.*, 1909, [iv], **28**, 333—347; *Zeitsch. Chem. Ind. Kolloide*, 1909, **5**, 238—243).—The capillary ascension of a dye in a strip of a textile fabric suspended in contact with the dye solution varies strictly inversely as the adsorption of the colour by the fabric. Positive and negative ions influence the amount of capillary ascension differently with different dyes. In general, any electrolyte which tends to diminish the electric charge on the colloidal particles of the dye coagulates the colour, increasing the adsorption and decreasing the ascension. R. J. C.

The Influence of Electrolytes in Different Concentrations on the Dyeing Process. Louis Pelet-Jolivet and Hans Siegrist (*Zeitsch. Chem. Ind. Kolloide*, 1909, **5**, 235—237).—Continuation of earlier work with the view of examining Justin-Mueller's hypothesis, that the influence of electrolytes in the dyeing process is a function of their effect in diminishing the solubility of the dye.

The dyeing process in the presence of electrolytes is related to the contact electrification produced. G. S. W.

Solubility Influences. III. Victor Rothmund (*Zeitsch. physikal. Chem.*, 1909, 69, 523—546. Compare Abstr., 1900, ii, 467; 1902, ii, 447).—In the first part of the paper, a rather complicated general equation representing the mutual influence of substances on their respective solubilities is deduced. From this equation, by means of certain simplifying assumptions, the equation $1/C\log_e(\eta_1/\eta'_1) = \alpha/RT = \beta$ (1), representing the influence of a non-electrolyte on the solubility of an electrolyte, is deduced; in this equation, c represents the concentration of the non-electrolyte, η_1/η'_1 the ratio of the amounts of dissolved electrolyte before and after the addition of the non-electrolyte, and β is a constant. A corresponding equation for the influence of a salt on the solubility of a non-electrolyte is also deduced.

The influence of twenty-three non-electrolytes (organic compounds) on the solubility in water of lithium carbonate, silver sulphate, potassium bromate, potassium perchlorate, and strontium hydroxide (all slightly soluble salts) has been determined at 25°. For lithium carbonate, the non-electrolytes were employed in $N/8$, $N/4$, $N/2$, and N solution; for the other salts, only $N/2$-solutions were used. The solubilities are throughout referred to equal volumes of solution, and not to equal amounts of water.

The solubility of lithium carbonate in water at 25° amounts to 0·1687 mol. per litre; it is increased by mannitol, dextrose, sucrose, and mercuric cyanide, and is diminished by the other electrolytes; the effect of the three sugars is ascribed to salt formation. From the observations of different concentrations of non-electrolytes on the solubility of this salt, it is shown that equation (1) represents the results satisfactorily, and the results of all the experiments are therefore calculated according to this equation and given in terms of 100 β. The solubilities of the other salts in water in mols. per litre are as follows; silver sulphate, 0·0267; potassium bromate, 0·478; potassium perchlorate 0·1475, and strontium hydroxide, 0·0835. The solubility of silver sulphate is increased by the addition of acetonitrile, carbamide, mannitol, phenol, and other subtances; that of potassium bromate by glycine only, and that of potassium perchlorate by formamide and carbamide. The solubility of strontium hydroxide is increased by glycerol, ethylene glycol, and mannitol. In all other cases non-electrolytes diminish the solubility.

The validity of a deduction previously made by the author (*loc. cit.*), that the diminution of solubility of a salt caused by a non-electrolyte is so much the greater the more effective the salt itself is in diminishing the solubility of non-electrolytes, appears to be confirmed by the results.

The observations are also discussed from the point of view of hydration in solution. Philip's method of calculating the hydration of salts from their effect in diminishing the solubility of non-electrolytes (Trans., 1907, 91, 711) is regarded as untenable, and the views of Abegg (*Zeitsch. Elektrochem.*, 1901, 7, 677) and of Hudson (this vol., ii, 131) on hydration in solution are also adversely criticised. G. S.

Piezochemical Studies. IV. Electrical Determination of the Influence of Pressure on the Solubility. ERNST COHEN and L. R. SINNIGE (*Zeitsch. physikal. Chem.*, 1909, 69, 102—109. Compare this vol., ii, 291, 641, 796, 857).—The solubility of cadmium sulphate and of zinc sulphate, under different pressures has been determined by an indirect method depending on measurements of *E.M.F.* Different cells of the Weston type containing (1) a saturated solution of the salt in question, in contact with the solid; (2) a saturated solution, not in contact with solid; (3) an unsaturated solution of the salt of known concentration, were used, and the measurements were made at 25° in the compression apparatus already described. The solubility of $CdSO_4,8/3H_2O$, at 25°, expressed in grams of the anhydrous salt to 100 grams of water, is as follows: 76·80 at 1 atmos., 77·53 at 250 atmos., 78·02 at 500 atmos., 78·60 at 750 atmos., and 78·96 at 1000 atmos. For $ZnSO_4,7H_2O$, at 25°, 57·95 grams anhydrous salt at 1 atmos., 57·84 grams at 250 atmos., 57·84 grams at 500 atmos., 57·67 at 750 atmos., and 57·74 at 1000 atmos. The results are in all cases in excellent agreement with those obtained by the direct method.

The electromotive method cannot be employed when the solubility diminishes with increase of pressure unless supersaturation occurs, as in the case of zinc sulphate. G. S.

Influence of Pressure on the Miscibility of Two Liquids. J. TIMMERMANS and PHILIPP KOHNSTAMM (*Proc. K. Acad. Wetensch. Amsterdam*, 1909, 12, 234—244).—Measurements have been made of the influence of pressure on the critical solution temperature of a large number of pairs of substances. The results are discussed in reference to the general theory of plait-point curves, and the various systems are classified according to the nature of the observed pressure influence. H. M. D.

Theory of Concentrated Solutions. HANS G. MÖLLER (*Zeitsch. physikal. Chem.*, 1909, 69, 449—459).—Dolezalek (compare this vol., ii, 22) has proposed a theory of concentrated solutions, based on the assumption that the partial pressure of each form of substance is proportional to the molar proportion of it present in the mixture, and has tested it by application to the experimental data for the vapour pressures of binary mixtures due to Zawidzki (Abstr., 1901, ii, 6). The author points out that a crucial proof of the value of the theory can be obtained by calculating the partial pressures of the components of a binary mixture *AB* from the experimental data for the systems *AC* and *BD*, and comparing them with the observed values.

The two systems chosen are carbon tetrachloride–benzene and ethyl acetate–ethyl iodide, and from the results the partial pressures of the components in the system carbon tetrachloride–ethyl acetate have been calculated; the agreement between observed and calculated values is excellent. In the course of the investigation, it is shown that ethyl iodide contains single and triple molecules, about two-thirds of it being present in the latter form under the experimental conditions, and ethyl acetate contains about 28% of double molecules. G. S.

Solid Solutions of the Elements. W. GUERTLER (*Zeitsch. physikal. Chem.*, 1909, 68, 177—203).—From a critical consideration of observations relating to the formation of mixed crystals by elementary substances, the author arrives at the conclusion that the factors which determine the formation of these solid solutions are similar to those which are operative in the case of liquid solutions, and that the part played by isomorphism is not of essential importance. In support of the analogy between liquid and solid solutions, attention is drawn to the occurrence of diffusion in mixed crystals, to the fact that thermal changes accompany their formation, and further, to the influence of temperature on the formation of mixed crystals. It seems probable that all pairs of elements are capable of forming mixed crystals, if only to a very limited extent, and this is again analogous to the universal miscibility of pairs of liquids. On the other hand, the influence of the crystalline form of the component elements on the ability to yield mixed crystals appears to be very limited. Many pairs of elements which crystallise in the same form only yield mixed crystals to a very slight extent, although both components form a complete series of mixed crystals with a third isomorphous element. Similarly, it is found that many elements give rise to extensive series of mixed crystals, although the elements crystallise in forms belonging to different systems.

The frequent occurrence of mixed crystal aggregates containing compounds of two elements and one or other of the components is also discussed. H. M. D.

Solubility in the Solid State between Aromatic Compounds and the Corresponding Hexahydrogenated [Completely Hydrogenated] Compounds. LUIGI MASCARELLI and V. BABINI (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 222—228).—The authors have studied cryoscopically the mutual solubility of various aromatic compounds and the corresponding completely hydrogenated compounds (compare Mascarelli and Pestalozza, Abstr., 1908, i, 527). The following are the mean molecular depressions of freezing point for certain of these compounds, which have not been previously used as cryoscopic solvents: benzanilide, 96·5; benzoyl*cyclo*hexylamine, $C_6H_{11}\cdot NHBz$, 142; hexachloro*cyclo*hexane, 165; hexachlorobenzene, 207·5, a value higher than that for any other cryoscopic solvent.

Di*cyclo*hexyl has the normal molecular weight in diphenyl. With di*cyclo*hexylethane, $C_6H_{11}\cdot CH_2\cdot CH_2\cdot C_6H_{11}$, dissolved in dibenzil, somewhat discordant cryoscopic results are obtained, but these are not such as to indicate abnormal behaviour. Decahydronaphthalene dissolved in naphthalene behaves normally. With decahydro-β-naphthol in β naphthol solution, the molecular weights obtained are in all cases lower than the calculated value, and vary from 124 to 152, owing to the fact that the solvent does not readily exhibit its true freezing point; the results show, however, that these two compounds do not form solid solutions. Benzoyl*cyclo*hexylamine has the normal molecular weight in freezing benzanilide, but the latter gives molecular weights varying from 300 to 306, instead of 197, in benzoyl*cyclo*hexylamine solutions. Similarly, hexachloro*cyclo*hexane exhibits normal cryoscopic behaviour in hexachlorobenzene, whilst the latter gives molecular weights varying from 310 to 337, instead of 285, in freezing hexachloro*cyclo*hexane (compare Mascarelli and Pestalozza, Abstr., 1907, ii, 936). T. H. P.

Ultramicroscopical Investigations. J. AMANN (*Chem. Zentr.*, 1909, ii, 1031; from *Schweiz. Woch. Chem. Pharm.*, 1909, 47, 439—443).—(1) Ultramicroscopes.—One of the most practical systems is Wenham's paraboloid. (2) Many pharmaceutical preparations have been found to be pseudo-solutions, and it was found that the therapeutic activity of these drugs depends on the condition of the pseudo-solution. (3) Some substances insoluble in water are rendered soluble by colloids. The colloidal solution of egg-albumin in the course of a few days dissolves trioxymethylene, and the pseudo-solution keeps for an unlimited time without change, but mineral acids give a precipitate. (4) A freshly prepared ammoniacal copper sulphate solution gives under the ultramicroscope the impression of a pseudo-solution of copper hydroxide in a true solution. On adding alcohol, and observing certain conditions, a colourless filtrate is obtained which proves to be a pseudo-solution. L. DE K.

Crystallisation from Aqueous Solutions. III. ROBERT MARC and WALTHER WENK (*Zeitsch. physikal. Chem.*, 1909, 68, 104—114. Compare Abstr., 1908, ii, 160; this vol., ii, 798).—The velocity of crystallisation of potassium sulphate is considerably accelerated by certain inorganic salts which are not markedly absorbed by the potassium sulphate crystals formed. The influence of colouring matters on the velocity of crystallisation of potassium sulphate has also been investigated; those which do not colour the salt have practically no influence (for example, methylene-blue), those which colour the salt slightly exert a retarding effect (for example, patent-blue), and those which colour the salt strongly almost completely inhibit the crystallisation of supersaturated solutions of potassium sulphate (for example, Bismarck-brown). That the latter phenomenon is not due to the coating of the crystals or nuclei with the colouring matter is shown by the fact that the colouring matters do not retard the dissolution of potassium sulphate by water. These results support the view already advanced (*loc. cit.*), that crystallisation is preceded by adsorption. G. S.

Crystals which are Absolutely Stable only at High Pressures. GUSTAV TAMMANN (*Zeitsch. physikal. Chem.*, 1909, 69, 569—584).—Crystalline substances which are unstable (pseudo-stable) at atmospheric pressure may have a field of absolute stability at higher pressures, provided that the modification unstable at lower pressures has a greater density than the stable modification. This possibility is in accordance with van't Hoff's rule connecting displacement of equilibrium with pressure. Whether the transition takes place on increasing the pressure depends on two factors: (1) the power of spontaneous transition; (2) the velocity of the transition, and these factors are discussed in detail for the transition curve of phenol I to phenol II (compare Tammann, *Schmelzen und Krystallizieren*, Leipzig, 1903).

If the form stable at atmospheric pressure is transformed to the other modification by applying very high pressures, and the new modification is then rapidly cooled, it should be possible to obtain it in a pseudo-stable form at low pressures if the spontaneous transition and the velocity of transition are sufficiently small. This has actually been done for the forms of phenol and of ice known as phenol II and ice III. At 10°, phenol begins to change to phenol II at a pressure of about 2200 kg./cm.^{2} The pressure was raised to 3200 kg. in order to ensure that the transition was complete, then the phenol II was cooled to $-80°$ in solid carbon dioxide, and the pressure slowly released. Phenol II remained stable when the pressure had fallen to 300 atmos. at $-80°$, and even between 0° and 10° under a pressure of 400 kg. Under suitable conditions it might be possible to obtain this form of phenol in open vessels. Similar experiments were made in order to obtain the dense unstable form of ice, ice III, at low pressures, but in this case the transition to the ordinary form took place between $-60°$ and $-40°$ under a pressure of 180—400 kg. There is some evidence that this transition takes place in two stages.

The relationship betweeen diamond and graphite is similar to that between phenol II and the ordinary form, and the transformation of graphite to diamond can theoretically be accomplished by the method described above.

Very little is known as to the possibility of obtaining the two forms from solution. G. S.

Formation of Solid Surfaces on Colloidal Liquids and their Photo-electric Behaviour. F. Plogmeier (*Ber. Deut. physikal. Ges.*, 1909, 382—396).—The development of photo-electric properties of solutions of colouring matters and inorganic colloids has been found to be due to the formation of a solid layer at the free surface of the solutions. Aqueous solutions of magenta, methyl-violet, Hofmann's violet, rhodamine, eosin, and naphthol-yellow were examined. Freshly formed surfaces of these solutions show little or no photo-electric effect, but as the age of the surface increases, the photo-electric qualities are developed. The sensitiveness increases rapidly at first, then more slowly, and approaches a constant limiting value. This limiting value is almost independent of the concentration of the solution, but the time required for the attainment of this value diminishes as the concentration increases.

Experiments with solutions of magenta in contact with air, carbon dioxide, and hydrogen show that the formation of the solid surface layer which conditions the photo-electric sensitiveness is independent of the nature of the gas in contact with the solution. The phenomenon is therefore not due to the formation of an insoluble substance as the result of oxidation. On the other hand, it is shown that conditions which favour evaporation of the solvent are also favourable to the formation of the surface layer.

This is also found to be accelerated when electrolytes are added to the solution; the addition of non-electrolytes is without any appreciable effect.

Similar results were obtained when colloidal solutions of gold, silver, and palladium were examined. On the other hand, photoelectric sensitiveness was not always developed in the case of colloidal solutions of arsenious and antimony sulphides, although surface layers could be detected. This is supposed to be due to the circumstance that the surface layers in these cases are discontinuous, and are therefore wetted by the solution.

The author expresses the view that the phenomenon investigated is essentially dependent on the colloidal character of the solution. When the colloidal particles come within the range of the "dead space" at the surface of the solution, their mobility is lowered to such an extent that they cannot escape to the interior, and a process of segregation results. H. M. D.

Heterogeneous Equilibria of Dissociating Compounds. F. E. C. SCHEFFER (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, **12**, 257—265).—The six types of equilibrium curves are discussed in which intersection of the plait-point curve and the three-phase line of a dissociating binary compound occurs. With ammonia, hydrogen chloride, hydrogen sulphide, and carbon dioxide form systems which belong to the same type; a different type is furnished, however, by ammonia and sulphur dioxide.

Quantitative data for the system ammonia–hydrogen sulphide are recorded. H. M. D.

The System Water–Sodium Sulphate. ANDREAS SMITS and J. P. WUITE (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, **12**, 244—257).—The vapour pressures corresponding with the various three-phase systems built up from water and sodium sulphate have been determined for a series of temperatures. At 32·4°, when the decahydrate is transformed into the anhydrous salt, the vapour pressure of the system is 30·8 mm. of mercury. At 24·4°, when the heptahydrate is converted into the anhydrous salt, the pressure amounts to 18·9 mm. The vapour pressures of the saturated solution of the anhydrous salt are recorded for temperatures between 50° and 260°. When these pressures are compared with the vapour pressures of pure water a maximum difference is found at about 234°, which is the temperature at which rhombic sodium sulphate is converted into a monoclinic form.

The composition of the saturated solution of sodium sulphate has also been determined for temperatures between 62° and 319°. The curve representing the solubility of the rhombic form is of retrograde character, the solubility falling to a minimum and then increasing. From 240° to 319°, when the solid phase in contact with the solution is the monoclinic form of sodium sulphate, the solubility decreases rapidly. At 365° the critical phenomenon is observed, and since this temperature is practically identical with the critical temperature of pure water, the authors conclude that the saturated solution at this temperature contains very little sodium sulphate. H. M. D.

The Impassable Line in Systems of Three Components and its Relation to the Law of Combining Weights. RUDOLF RUER (*Zeitsch. physikal. Chem.*, 1909, **68**, 1—31).—A theoretical paper. Ostwald (*Lehrbuch* II, 2, 991) has shown that when a two-phase system of three components is represented in the usual way by an equilateral triangle, and there is a special point *D* on the line *AB* (representing, for example, a maximum or minimum point on the freezing-point or boiling-point curve), the line *CD* divides the triangle into two sections in such a way that the points representing the composition of the ternary system in one of these sections differ from those in the other section with reference to the components from which they are built up, and in this sense it is not possible to cross the line *CD* from one section to the other. Schreinemakers (Abstr., 1901, ii, 57, 146) has pointed out certain objections to Ostwald's views.

The author shows that the line *CD* can, in general, be crossed when *D* represents a binary mixture of *A* and *B*, but not when *D* represents a chemical compound. The general relations which must hold in order that it may not be possible to cross the line *CD* from one triangle to the other are worked out mathematically. G. S.

Equilibria in Quaternary Systems. The System: Sodium Oxide, Barium Oxide, Hydrochloric Acid, and Water. Franz A. H. Schreinemakers (*Zeitsch. physikal. Chem.*, 1909, 68, 83—103). —The various points in the equilibrium figure have been determined by solubility measurements at 30° in the usual way, and the results confirmed by the "residue" method. The measurements and figures are complicated by the occurrence of a large number of salts and hydrates, including the compound $BaCl(OH),2H_2O$, already described by Beckmann. G. S.

Isomorphous Mixtures. The Systems *o*-, *m*-, and *p*-Chloronitrobenzene and *o*-, *m*-, and *p*-Bromonitrobenzene. Robert Kremann (*Jahrb. K. K. Geol. Reichsanstalt*, 1908, 58, 659—672). —The isomorphous mixtures formed by the three corresponding chloro- and bromo-nitrobenzenes have been examined. Temperature-concentration curves are given, showing the relationships between the co-existing liquid and solid phases. In the case of the ortho-compounds, the melting point of each component is lowered to a small extent on addition of the second component. On the other hand, the melting points of *m*- and *p*-chloronitrobenzenes are raised on addition of the corresponding bromo-compounds. The melting-point curves in those two cases show a distinct break, indicating the existence of two series of isomorphous mixtures.

The crystals which separate on cooling from liquid mixtures of the ortho compounds contain a smaller proportion of the bromo-compound than that which is present in the salt. The reverse holds for mixtures of the meta- and para-compounds. The observed differences in respect of the formation of isomorphous mixtures are attributed to the action of forces of the same nature as those which give rise to the phenomenon of steric hindrance. In view of the possibility that the differences might be due to the formation of double molecules in the case of the ortho compounds, the temperature-coefficients of the molecular surface energy were determined for equimolecular mixtures of the three series of compounds, but in all cases these coefficients were found to have a normal value. H. M. D.

P, T, X-Spacial Representation of the System Ether–Anthraquinone. ANDREAS SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, 12, 231—233).—Since the usual method of representing the pressure, temperature, concentration relationships in space is not well adapted to systems in which the two components are physically very different, an alternative method of spacial representation is described and illustrated for the case of ether and anthraquinone. H. M. D.

Chemical Dynamics of the Alkyl Iodides. KATHARINE A. BURKE and FREDERICK G. DONNAN (*Zeitsch. physikal. Chem.*, 1909, 69, 148—168. Compare Trans., 1904, 85, 555).—The paper contains an account of further experiments undertaken with the object of elucidating the nature of the reaction between silver nitrate and alkyl iodides in alcoholic solution.

The main products of the reaction, nitric acid, alkyl nitrate, and ether, have practically no effect on the velocity of the reaction. The rate of the reaction between ethyl iodide and silver nitrate is accelerated by calcium nitrate, and to a still greater extent by ammonium nitrate. This result is probably due to the effect of the NO_3'-ions in diminishing the ionisation of the silver nitrate, as the authors consider that it is the non-ionised silver nitrate which reacts with the alkyl iodide. If the view as to the accelerating influence of NO_3'-ions is correct, nitric acid, which does not accelerate the reaction, must be much less ionised in alcoholic solution than ammonium nitrate under corresponding conditions, a deduction which has been confirmed by electrical conductivity measurements.

Under varying conditions, about 70% of the total silver nitrate used up always appears as nitric acid, the remainder as ethyl nitrate, a result which proves that these products are formed in simultaneous reactions.

The reaction between methyl iodide and silver nitrate has been measured at 24·5° in mixtures of ethyl alcohol and water in varying proportions, and the corresponding reaction with ethyl iodide in mixtures containing up to 60% of water. The initial concentrations both of alkyl iodide and silver nitrate were $n/40$ in each case. With methyl iodide the velocity attains a maximum in mixtures containing 5% of water, and falls off regularly as the proportion of water is further increased. With ethyl alcohol there is also a maximum at 5% of water, but the velocity reaches a minimum at about 35° of water, and increases slowly up to 60% of water, beyond which point the experiments could not be carried out, owing to the insolubility of ethyl iodide in the mixed solvent. The proportion of acid formed in the mixed solvent appears to be greater than in either of the pure solvents.

As regards the mechanism of these reactions, the authors agree with Wegscheider (Abstr., 1907, i, 373) that it is probably the non-ionised silver nitrate which reacts, but some points still remain unexplained.

The fact that the order of the reactivity of the alkyl iodides as measured by silver nitrate is different from that obtained in other ways may be connected with the fact that in the former case the solvent plays a part in the reaction. G. S.

Correction. (Formation of Esters.) Heinrich Goldschmidt (*Zeitsch Elektrochem.*, 1909, 740—742).—A claim of priority against Kailan (this vol., ii, 723). T. E.

Relation between the Structure of the Aliphatic Alcohols and their Rate of Esterification. Boris N. Menschutkin (*Ber.*, 1909, 42, 4020—4021).—It is pointed out that Michael and Wolgast (this vol., ii, 873) have not referred to some of the later work of N. Menschutkin (Abstr., 1893, i, 158). J. J. S.

Synthetic Ferment Action. Jacobus H. van't Hoff (*Sitzungsber. K. Akad. Berlin*, 1909, 42, 1065—1074).—If an enzyme is an ideal catalyst it should have no effect on the actual equilibrium attained. In most cases, especially those which are of biological importance, it is impossible to determine the equilibrium constant in the absence of an enzyme, so that it is difficult to submit the above statement to direct experimental proof. The following method is suggested by the author, and is worked out in the case of the equilibrium in the system: benzoic acid, phenol, phenyl benzoate, and water, which is typical of the hydrolytic decomposition and synthetic formation of a fat. The method is based on the following principle: In the case of optical antipodes in equilibrium there is no heat of reaction and no tendency for the solids to change one into the other. When mixed in equal quantities they will be in equilibrium with the fused mass, the vapour, or the saturated solution, and the whole system is inactive; from thermodynamic principles it follows that the equilibrium constant is 1($\log k = 0$). In equilibria where the heat of reaction is zero or approximately so, as is the case in enzymatic processes which depend on the addition of water and the subsequent splitting of the molecule, the position of equilibrium will thus be characterised by that existing in the condensed system, that is, when ester and ice are in equilibrium with the solid mixture of alcohol and acid. The saturated vapour, fusion, or saturated solution in contact with this condensed system will also have the same equilibrium when thermoneutrality exists. Thus, from the compositions of the saturated solutions or vapour, the equilibrium can be determined.

The mixture of phenol, benzoic acid, phenyl benzoate, and water gives two cryohydric mixtures at $-1{\cdot}2°$ and $-10°$, the compositions of which, in parts by weight, were found to be:

	Water.	Ester.	Acid.	Phenol.
At $-1{\cdot}2°$	938	0·02	1·57	60
At $-10°$	58	263	74	605
Vapour at 0°	0·0019	$0{\cdot}0_415$	$0{\cdot}0_315$	0·0022

The last line represents the composition of the saturated vapour. This was not determined directly, but calculated by making use either of the rule of corresponding conditions or of Trouton's rule.

The equilibrium constant, [water][ester]/[acid][phenol] = K, calculated from these results has the values: Calculated (*a*) from the solutions, 0·64 – 1·1; (*b*) by rule of corresponding conditions, 0·7 – 1·9; (*c*) from Trouton's rule, 0·43 – 1·8, that is, it lies in the neighbourhood of 1. It is therefore very probable that $\log k = 0$.

Assuming that the relation $\log k = 0$ holds for a system, the author draws certain conclusions with respect to isomerism and molecular symmetry. He also deduces, by making use of Trouton's rule, that when four substances are in equilibrium, and thermoneutrality exists, the sum of the boiling points, taking those of the reciprocal system as negative, is zero. This corresponds with Kopp's additive rule with respect to boiling points, which can therefore only hold when thermoneutrality exists.

It is pointed out that Menschutkin's work on esterification can be used to indicate the equilibrium point in hydrolytic decompositions or the reverse syntheses, assuming that enzymes act as ideal catalysts.

T. S. P.

Fundamental Stoicheiometric Laws and the Atomic Theory. WILHELM OSTWALD (*Zeitsch. physikal. Chem.*, 1909, **69**, 506—511).—A short recapitulation of the author's Faraday lecture (Trans., 1904, **85**, 506). G. S.

Importance of Physical Chemistry for the Determination of Atomic Weights. PHILIPPE A. GUYE (*Zeitsch. physikal. Chem.*, 1909, **69**, 315—336).—The author shows how the principles of physical chemistry have contributed to increased accuracy in atomic weight determinations, and indicates the lines along which further advances may be made. G. S.

Vacuum Correction of Weighings Applied to Atomic Weight Determinations. PHILIPPE A. GUYE and N. ZACHARIADES (*Compt. rend.*, 1909, **149**, 593—594).—The usual correction for reducing a weighing to the vacuum value, based on the density of the substance weighed, is always too high, because a counter correction should be made for the weight of gases or vapours condensed on the surface of the substance. The authors have determined the magnitude of this error in the case of a number of powdered chlorides, bromides, sulphates, etc., by direct weighings in a vacuum.

The error on 100 grams varies from 1 mg. in the case of cupric oxide to 33 mg. in the case of potassium nitrate. It depends on the physical condition of the substance, being 5 mg. for fused potassium chloride, 20 mg. for crystals, and 32 mg. for fine powder. It is altogether fallacious to weigh more accurately than to 1 part in 10,000 in air, or to calculate atomic weights with any greater precision than this, when they are founded on weighings in air corrected for displacement by calculation (compare Scott, Proc., 1909, **25**, 286). R. J. C.

Influence of Mass Distribution in the Molecule on the Magnitude of the Molecular Forces. EMIL BOSE and MARGRETE BOSE (*Zeitsch. physikal. Chem.*, 1909, **69**, 52—68).—A theoretical paper. Certain considerations lead to the conclusion that the molecular forces may advantageously be regarded as localised in different parts of the molecule, and not, as is usually assumed, at the centre of the molecule. The consequences of this assumption are tested, mainly by reference to the attraction constant, a, of van der Waals' equation, the values of a for substances of approximately equal molecular weight being compared, as well as cases in which, for approximately equal values of a, the molecular weights are different. The hypothesis also throws some light on certain regularities in the boiling points of organic compounds. G. S.

Theoretical Basis of Structural Formulæ for Inorganic Substances. Alfred Werner (*Arch. Sci. phys. nat.*, 1909, [iv], **28**, 317—332).—Theoretical. An account of the author's well-known theory on this subject. R. J. C.

A Simple Mechanical Shaker. Douglas H. B. Couman (*Chem. News*, 1909, **100**, 209).—Steam, generated in a copper bottle of one-litre capacity, is directed by means of a glass outlet tube, provided with a jet, against a series of metallic vanes inserted round a cork. The latter is placed on the top of a stirring rod, which rotates in a glass collar in which it is supported by an enlargement of the rod. The glass collar is held in position by two lateral brass supports, placed one above the other at a suitable angle, and soldered to the boiler. The apparatus is figured in the original. T. A. H.

Laboratory Methods. Ernest Murmann (*Oesterr. Chem. Zeit.*, 1909, **12**, 145—146).—The author describes the following apparatus and processes: (1) a convenient form of Kipp's apparatus; (2) a method for fastening down crucible lids with carborundum; (3) a convenient "tube" crucible; (4) a form of tripod; (5) a distillation apparatus; (6) an easily fusible alloy (m. p. 95—100°) containing cadmium 2·248, tin 3·570, thallium 4·082, and bismuth 12·510 parts; (7) a rapid method of preparing a perchlorate; (8) a colorimetric method of estimating manganese; (9) the collection and washing of magnesium ammonium phosphate. F. M. G. M.

Inorganic Chemistry.

[Catalytic Action of Colloidal Palladium on the Union of Hydrogen and Oxygen.] Carl Paal and Wilhelm Hartmann (*J. pr. Chem.*, 1909, [ii], **80**, 337—348).—The rate of combination of hydrogen and oxygen under the catalytic influence of colloidal palladium in presence of sodium protalbinate as protective colloid has been investigated. When excess of hydrogen is present in the gas mixture, the velocity of the reaction is greater than when the hydrogen and oxygen are present in the volume ratio 2 : 1. On the other hand, excess of oxygen lowers the reaction velocity. In the former case a maximum velocity is reached when the effect of the excess of hydrogen is counter-balanced by the diminishing concentration of the oxygen in the reaction mixture.

The observations show that palladium behaves differently from platinum in its catalytic influence on the union of hydrogen and oxygen. In the case of platinum, a maximum velocity is found when the two gases have the volume ratio 2 : 1. It is suggested that the large adsorptive power of palladium for hydrogen is the cause of the observed velocity differences. H. M. D.

Density of Hydrogen Chloride; Atomic Weight of Chlorine. Otto Scheuer (*Compt. rend.*, 1909, **149**, 599—601. Compare Gray and Burt, Trans., 1909, **95**, 1633).—The density of hydrogen chloride prepared from sodium chloride and sulphuric acid, dried by phosphoric oxide, and purified by fractional distillation, was determined by direct weighing of a number of bulbs filled simultaneously. The values obtained in seven series of observations comprising twenty-eight determinations in all are strikingly concordant, and give as final value (arithmetic mean) 1·6394 grams as the weight of one litre of the gas.

Combining with this determination the critical constants of hydrogen chloride determined by Leduc or by Briner, or the coefficient of compressibility determined by Leduc and Sacerdote, the author calculates that the atomic weight of chlorine is certainly very near 35·45. R. J. C.

Oxidation of Iodine by Ozone. Fr. Fichter and Franz Rohner (*Ber.*, 1909, **42**, 4093—4100. Compare Muir, Trans., 1909, **95**, 656.)—When a saturated solution of iodine in chloroform is treated with ozone (8%), an amorphous, yellowish-white precipitate is obtained, which consists of a compound of iodine and oxygen. It is very sensitive to moisture, deliquescing to an almost black syrup. If the deliquescent mass is exposed to the air for some days, vapours of iodine are gradually evolved, and a residue of crystals of iodic acid left, the water which was formerly absorbed gradually evaporating. The same product can be obtained, but not so conveniently, by treating powdered and dry iodine with ozone at a temperature of 40—50°. Analysis points to the formula I_4O_9, rather than to I_2O_4 or I_3O_7. Its properties do not agree with those of Millon's oxide, I_2O_4 (*J. pr. Chem.*, 1845, **34**, 321).

On being heated, iodine vapours begin to be evolved at 75°, and between 120—130° there is a vigorous decomposition, the whole mass swelling up. It reacts violently with phenol, iodine being evolved. Concentrated sulphuric acid dissolves it in the cold, and the solution deposits crystals of Millon's sulphate, which are possibly a mixture of $I_2O_3,SO_3,\frac{1}{2}H_2O$ with iodine pentoxide (Chrétien, Abstr., 1897, ii, 138).

The compound I_4O_9 is considered to be the iodate of tervalent iodine. With water it reacts, giving iodic acid and iodine trihydroxide: $I(IO_3)_3 + 3H_2O = I(OH)_3 + 3HIO_3$. The iodine hydroxide then decomposes, thus: $3I(OH)_3 = 2HIO_3 + HI + 3H_2O$, and iodine is formed from the interaction of the iodic acid and hydrogen iodide.

Millon's compound of the composition I_2O_4 is to be considered as a basic iodate of iodine, namely, $O:I(IO_3)$. T. S. P.

Preparation of Hydrogen Iodide from Barium Peroxide, Iodine, and Sulphur Dioxide. Georg Kassner (*Chem. Zentr.*, 1909, ii, 1304; from *Apoth. Zeit.*, 1909, **24**, 562—563. Compare Bodroux, Abstr., 1906, ii, 156).—Finely-powdered iodine is mixed with the calculated quantity of barium peroxide, which has been ground up with water; oxygen is evolved, and a solution of barium iodide formed. To this solution, after filtration from barium carbonate and the excess of barium peroxide, is added a further quantity of iodine equal to that originally taken, and then sulphur dioxide passed in; barium sulphate is precipitated, and the solution gradually becomes colourless. On distillation, a solution of constant composition (55% hydrogen iodide) distils over at 127°. At the same time, iodine vapours are formed in large quantity, there is an odour of hydrogen sulphide, and amorphous sulphur is deposited in the condenser. The latter is probably formed from the hydrogen sulphide and iodine, whereas the hydrogen sulphide is formed as a decomposition product of the barium sulphate. If sodium sulphite is heated with 55% hydrogen iodide, sulphur and iodine are formed in large quantities, and there is an odour of hydrogen sulphide. Thus, a solution of hydrogen iodide which is not very concentrated is a strong reducing agent.

It is impossible to prepare a pure dilute solution of hydrogen iodide from barium peroxide, iodine, and sulphur dioxide unless distillation is finally resorted to. T. S. P.

Aqueous Solutions of Hypoiodous Acid. Anton Skrabal and F. Buchta (*Chem. Zeit.*, 1909, **33**, 1184—1185, 1193—1195. Compare this vol., ii, 224).—The anomalous behaviour of iodine when oxidised by chlorine in aqueous solution is discussed in the light of previous researches. It is best explained by regarding the compound HIO, not as hypoiodous acid, but as a base, iodine hydroxide (compare Hartmann and Meyer, Abstr., 1894, i, 242, 461). In presence of an excess of hydrochloric acid, ICl is formed, and this is very stable. Solutions in sulphuric acid are unstable, owing to extensive hydrolysis. Sulphuric acid solutions are more stable in the presence of an excess of halogen, owing to the formation of the compounds I_3OH and ICl_2OH.

Tri-iodine hydroxide, I_3OH, is prepared in solution by oxidising a solution of potassium iodide and sulphuric acid with potassium permanganate and manganous sulphate, and reducing the excess with oxalic acid. For analysis, a definite volume of the solution is titrated with thiosulphate after adding potassium iodide: $5I_3OH + 5I' + 5H' = 5H_2O + 10I_2$. An equal volume is shaken with chloroform: $5I_3OH = 2H_2O + 7I_2 + H' + IO_3'$, and the aqueous solution titrated after addition of potassium iodide: $IO_3' + 5I' + 6H' = 3H_2O + 3I_2$. In a solution of the correct composition, the two quantities of iodine found are in the ratio 10 : 3

Iodine trichloride is to be regarded as $ICl:Cl_2$. It is decomposed by water according to the equation: $2ICl_3 + 3H_2O = 5HCl + ICl + HIO_3$.

The solution in hydrochloric acid is stable, that in sulphuric acid undergoes hydrolysis: $ICl_3 + H_2O = ICl_2OH + HCl$. C. H. D.

Basicity of Acids and the Constitution of Certain Anomalous Acid Salts. Giuseppe Bruni (*Zeitsch. physikal. Chem.*, 1909, **69**, 69—74).—Mainly a discussion of results already published (Abstr., 1908, ii, 935, 1012). The attempt was made to throw light on the nature of the so-called "ultra-acid" salts, for example, KF,HF and KIO_3,HIO_3, by measuring the change of electrical conductivity when the acid is progressively neutralised by addition of a base. Although the results are not conclusive as far as the main object of the investigation is concerned, the theory of the change of conductivity on neutralisation has been worked out, and is fully confirmed by experiment. G. S.

Apparatus for the Preparation of Pure Oxygen. Gustav Mossler (*Chem. Zentr.*, 1909, ii, 785—786; from *Zeitsch. Allg. Oesterr. Apoth. Ver.*, 1909, **43**, 301—302).—Large quantities of pure oxygen can be made by the interaction of 10% hydrogen peroxide and a concentrated solution of potassium permanganate acidified with sulphuric acid. T. S. P.

Demonstration of the Presence of Ozone in Flames. Wilhelm Manchot (*Ber.*, 1909, **42**, 3948—3951).—The presence of ozone in the flame of burning hydrogen (compare Fischer, Abstr., 1906, ii, 224) is readily proved by the action of the flame on silver (compare this vol., ii, 1003). A strip of clean silver is heated by immersing one end in a sand- or oil-bath at 260°. The flame used is a long one produced by burning a vigorous current of hydrogen at a narrow jet, and only the point of the flame is used to touch the silver. A black stain is rapidly produced, which is most intense where touched by the hottest part of the flame, as demanded by the theory of ozone formation. To produce an equal effect without a flame, oxygen containing 2 or 3% of ozone is necessary. The absence of ozone from the outside of a flame is due to its breaking down in passing through the zones of lower temperature. Blow-pipe and oxy-hydrogen flames give the ozone reaction. The reaction is not due to either oxides of nitrogen or hydrogen peroxide. The latter reacts with silver at 155°, but not at higher temperatures. Silver is a more sensitive reagent than tetramethyldi-*p*-aminophenylmethane.

The presence of hydrogen peroxide in the oxy-hydrogen flame is proved by allowing the flame to play on to the surface of a concentrated solution of a titanium salt, when an intense yellow coloration is produced in half a minute. Hydrogen peroxide is also present in the flame of moist carbon monoxide burning in moist oxygen. Neither ozone nor hydrogen peroxide is an agent in the process of combustion, their production being merely an effect of the high temperature of the flame. C. H. D.

Formation of Ozone in a Flame. Oscar Loew (*Ber.*, 1909, **42**, 4218—4219. Compare preceding abstract).—The author points out that as far back as 1870 (*Zeitsch. Chem.*, [ii], 6, 65, 269) he proved the formation of ozone in a flame. A strong current of air was blown through a tube into the flame of a Bunsen burner, and the gases collected; in a few seconds enough ozone had been collected to readily identify it by its intense odour and the common tests. T. S. P.

Structural Classification of Oxides, Oxygen Acids, and their Salts. Richard Abegg (*Zeitsch. physikal. Chem.*, 1909, 69, 1—14. Compare Abstr., 1904, ii, 475).—The author revives the suggestion of Berzelius that the oxy-salts are to be regarded as double oxides (K_2SO_4, for example, is represented as K_2O,SO_3), and discusses the nature of oxides, oxygen acids, and their salts from this point of view.

The mutual combining capacity of oxides, leading to the formation of hydrates (in which case one of the oxides is water) and other polyoxides and salts, is discussed, and from the available data it is shown that the driving force influencing the combination of oxides is the power of the resulting complex to split up into two parts of contrary electrical character; the more readily this polar differentiation can take place, the more stable is the complex molecule.

The different types of polyoxides are considered, and the general rule is provisionally laid down that the weaker the basic oxide so much the greater is the tendency of one mol. of the acidic oxide to combine with several mols. of the basic oxide, and, conversely, the weaker the basic oxide, the more readily are compounds of the type of acid salts formed. G. S.

The Reaction between Sulphuryl Chloride and Ammonia. Fritz Ephraim and Franz Michel (*Ber.*, 1909, 42, 3833—3849. Compare Abstr., 1902, ii, 14; 1905, ii, 312; Trans., 1900, 77, 324).—In previous work on the interaction between sulphuryl chloride and ammonia, the experiments have been so carried out that at first the sulphuryl chloride was in excess. The authors proceed in the opposite manner, a solution of sulphuryl chloride in light petroleum being added to a concentrated solution of ammonia in the same solvent, and a rapid current of ammonia being passed through the latter solution during the time the sulphuryl chloride is being added, so as to keep the ammonia in excess. The products of reaction with the second method are different from those obtained with the first method. Sulphamide and trisulphimide (or sulphomelide) are formed only to a very slight extent, the chief products being long-chain compounds which give sulphamide only by a secondary action. If ammonia is always present in excess, imidosulphamide is the chief product formed, but in other cases the chain with $4SO_2$-groups, namely:

$$NH_2\cdot SO_2\cdot NH\cdot SO_2\cdot NH\cdot SO_2\cdot NH\cdot SO_2\cdot NH_2,$$

seems to be favoured.

The substances were isolated in the form of their silver salts. The product of reaction in the light petroleum was dissolved in water, and the solution digested with freshly precipitated lead hydroxide to remove the ammonium chloride. After cooling and filtering, the filtrate was acidified with nitric acid, and the remaining chlorine precipitated with silver nitrate. After collecting the silver chloride, the filtrate was fractionally precipitated by ammonia. The first fraction was obtained by adding ammonia until the white, flocculent precipitate began to ball together, and then stirring for some minutes. The filtrate from this reacted acid; excess of ammonia was added, and the second and chief fraction was obtained. The filtrate was again acid, and gave a further precipitate of an impure product (not further investigated) on neutralising with ammonia. The silver salts were all amorphous, and contained irregularly varying amounts of water; they were very difficult to purify.

Second fraction.—White powder, only slightly affected by light. Analysis gave $(SO_2)_4N_5Ag_6H + 11H_2O$. Dissolves in hot silver nitrate, and could be fractionally recrystallised from the hot mother liquor. The fractions were unchanged in composition, except that the amount of water present was $1\frac{1}{2}H_2O$. The formula may be either

$Ag_2N{\cdot}SO_2{\cdot}NAg{\cdot}SO_2{\cdot}NH{\cdot}SO_2{\cdot}NAg{\cdot}SO_2{\cdot}NAg_2$ or $N(SO_2{\cdot}NAg_2)_2{\cdot}SO_2{\cdot}NH{\cdot}SO_2{\cdot}NAg_2$;

the latter is favoured.

First fraction.—This was not pure. After treatment with dilute ammonium hydroxide and then acetic acid, a product was obtained, which could not be recrystallised, and answered to the formula $(SO_2)_3N_5Ag_3H_6 + 5\frac{1}{2}H_2O$; it is considered to be an equimolecular mixture of silver sulphamide, $SO_2(NHAg)_2$, and silver imidosulphamide, $NAg(NH_2{\cdot}SO_2)_2$. On dissolving in a concentrated solution of pyridine nitrate and keeping, rhombic crystals of an additive product, $NAg(SO_2{\cdot}NH_2)_2,C_5H_5N$, were obtained.

In one experiment the fractionation with ammonia was carried out in four operations. The second fraction gave $(SO_2)_4N_5Ag_6H,28(?)H_2O$, and the third, $(SO_2)_4N_5Ag_7 + 8H_2O$.

In one experiment the reaction mixture was submitted to the prolonged action of ammonia, and the silver salt obtained in 9 fractions. Silver imidosulphamide, $(SO_2)_2N_3Ag_3H_2$, was obtained in each case, but the amount of water varied.

The silver salt, $(SO_2)_4N_5Ag_6H$, was treated with alkyl iodides and with potassium iodide, but with no very definite results.

In the preparation of sulphamide according to the method of Hantzsch and Holl (Abstr., 1902, ii, 14), a salt was obtained having the composition $(SO_2)_4N_7Ag_5H_8,4H_2O$; this is considered to be either $NH_4{\cdot}NAg{\cdot}SO_2{\cdot}NAg{\cdot}SO_2{\cdot}NAg{\cdot}SO_2{\cdot}NAg{\cdot}SO_2{\cdot}NAg{\cdot}NH_4$ or else a mixture of $2SO_2(NHAg)_2$ and $NAg(SO_2NH_2)_2$. T. S. P.

Transformations of Selenium. MAURICE COSTE (*Compt. rend.*, 1909, **149**, 674—675).—Sticks of fused selenium have D 4·302. On conversion into metallic selenium, cavities are formed, and although the product appears to have D 4·356, after repeatedly crushing and boiling the metallic selenium in toluene, it is found to have D 4·80. Metallic selenium is slightly soluble in potassium hydroxide, carbon disulphide, toluene, nitrobenzene, quinoline, and aniline. When crystallised by slowly cooling from 230° a solution in concentrated potassium hydroxide, metallic selenium is obtained in long needles of D 4·82 and m. p. 219°.

Rapid cooling of selenium solutions gives red selenium, which in presence of quinoline, aniline, or carbon disulphide, is converted into red crystals of D 4·455. Metallic selenium is not produced under these conditions, as supposed by Saunders, and although selenium precipitated by sulphur dioxide often turns black, it is owing to traces of the solvent, and the substance obtained does not melt below 250°. Crystalline red selenium is converted into metallic selenium by heating for some hours at 105—107·5°, or by raising the red selenium to its melting point (144°), when it is rapidly converted into the metallic variety, which solidifies.

The time required for the transformation of vitreous into metallic selenium in presence of toluene at 100°, as measured by the dilatometer, is one hour. The product contains cavities which render its density low. In presence of silver selenate, the rate of transformation is doubled, and the product, being without blow holes, has the full density. Arsenic, on the other hand, retards the transformation.

R. J. C.

Molecular Weight of Selenium in Solution. F. Olivari (*Atti. R. Accad. Lincei*, 1909, [v], **18**, ii, 264—268. Compare this vol., ii, 805).—Further cryoscopic measurements confirm the existence of selenium in iodine solution in the form of Se_2 (compare this vol., ii, 39), but the molecular weight corresponding with the diatomic molecule is attained only in solutions of greater concentration than 5%; in more dilute solutions, lower molecular weights are observed. The selenium which crystallises from solution in iodine is insoluble in carbon disulphide, and seems to be the metallic modification. The change of colour occurring in the violet solutions of iodine in carbon disulphide on shaking with amorphous selenium (compare Beckmann, this vol., ii, 642) is not necessarily to be attributed to a combination taking place between the two elements, but may be explained by the superposition of the two absorption spectra: (1) of the violet solution of iodine, and (2) of the yellow solution of selenium in carbon disulphide. T. H. P.

Complexity of Tellurium. Philip E. Browning and William R. Flint (*Amer. J. Sci.*, 1909, **28**, 347—352; *Zeitsch. anorg. Chem.*, 1909, **64**, 112—118. Compare Abstr., 1908, ii, 33; Trans., 1907, **91**, 1849).—When water is added in large amount to a solution of tellurium tetrachloride, this compound is hydrolysed, and the greater part of the tellurous acid is precipitated, whilst some of the tellurium remains in solution, however, large the amount of water present. The tellurium remaining in solution may be completely precipitated as the dioxide by heating to boiling, and treating first with ammonia and then with acetic acid in faint excess (this vol., ii, 934).

These observations suggested a possible method for decomposing tellurium, on the assumption that it is a complex substance. Ninety-two grams of purified tellurium were submitted to repeated fractionation, being first converted into the tetrachloride and precipitated as above, the two end-fractions being denoted as the water fraction (α) and the ammonia-acetic acid fraction (β). These two fractions were converted into the basic nitrate, $2TeO_2,HNO_3$, and analysed according to three different methods, namely: 1. The basic nitrate method (Norris, *J. Amer. Chem. Soc.*, 1906. 28, 1675). 2. Gooch and Danner's modification of Brauner's permanganate method (Abstr., 1893, ii, 15). 3. The ammonia-acetic acid method (*loc. cit.*). From the mean percentages of dioxide thus obtained, the atomic weight of tellurium in the α-fractions was calculated to be 126·53, 126·64, and 126·31 respectively, giving a mean of 126·49. From the β-fractions the calculated atomic weights were 128·97, 128·77, and 128·81, the mean being 128·85.

Two portions of tellurium dioxide from each fraction, prepared by the ignition of the basic nitrates, were dissolved in equal amounts of hydrochloric acid, and treated with equal amounts of boiling distilled water. The results obtained indicated different degrees of hydrolytic susceptibility on the part of the tetrachloride prepared from these fractions.

The material used in the above experiments was carefully examined for impurities, but such were not found. There is therefore no explanation of the differences observed other than the complexity of the original substance. T. S. P.

Compounds of Ammonia and Water. Andreas Smits and S. Postma (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, **12**, 186—188).—In connexion with the question of the form in which ammonia is present in its aqueous solutions, the authors have determined what compounds are deposited when various mixtures of ammonia and water are cooled. The freezing-point curves indicate that the two compounds NH_3,H_2O and $2NH_3,H_2O$ are formed; these melt at $-77°$ and $-78°$ respectively. H. M. D.

Formation of Nitric Oxide in the Carbon Monoxide Flame. Fritz Haber and Joseph E. Coates (*Zeitsch. physikal. Chem.*, 1909, **69**, 337—388).—The method of experiment was a modification of that described in previous papers (compare this vol., ii, 384, 801). The arrangements for working under high pressure (up to 45 atmospheres) are described in detail.

With a mixture of nitrogen and oxygen in equal volumes at the ordinary pressure, very little nitric oxide is obtained, even when the gases are previously warmed to 800° before entering the combustion chamber. The yield of nitrous products is greatly increased by increasing the pressure above 5 atmospheres. With the same mixture at 5 atmospheres, an amount of nitrous products equivalent to 4—5 mols. of nitric acid per 100 mols. of carbon dioxide is obtained without preliminary heating, and when the gases are previously heated, as much as 6 mols. of nitric acid are obtained. Increasing the pressure from 5 to 9 atmospheres increases the yield, but a further increase to 45 atmospheres has not much effect. When air is used instead of equal volumes of nitrogen and oxygen, and the gases are not previously heated, the yield is small even under pressure, but when the gases are previously heated, 3 mols. of nitric acid per 100 mols. of carbon dioxide are obtained. A considerable increase of temperature does not greatly affect the yield, so that the temperature-coefficient of the reaction is very small under the experimental conditions.

The yield of nitric oxide is calculated on the assumption that equilibrium is established in the neighbourhood of 2400°, and that it is not displaced on cooling. A comparison appears to show that the amounts obtained are greater than the calculated values. Although this is not regarded as definitely proved, owing to the uncertainty of some of the assumptions made in the calculations, there appears to be some evidence that, apart from purely thermal effects, the occurrence of ionisation in certain regions of the flame is also of importance for the yield of nitrous products.

Nitric oxide is also formed by combination of nitrogen and oxygen in the electric arc, the electric spark, and at white-hot solid surfaces. Although in these circumstances the yields are not greater than the values calculated from the thermal effects alone, yet ionisation may play a part as well. Some support is afforded to this view by the fact that previous warming of the reacting substances greatly increases the yield of nitrous products. From purely thermal considerations, the yield must depend greatly on the prevention of decomposition of the products by cooling them as rapidly as possible, and this would not be favoured by previous warming of the reacting substances.

G. S.

Dynamic Allotropy of Phosphorus. ERNST COHEN and J. OLIE, Jun. (*Chem. Weekblad*, 1909, **6**, 821—848. Compare Hittorf, *Ann. Phys. Chem.*, 1865, **126**, 193; Lemoine, this Journ., 1871, **24**, 1157; Troost and Hautefeuille, Abstr., 1874, 769; Arctowski, Abstr., 1896, ii, 559; Chapman, Trans., 1899, **75**, 734; Noelting and Feuerstein, Abstr., 1900, ii, 722; Giran, Abstr., 1903, ii, 362; Schenck, Abstr., 1905, ii, 244; Siemens, Abstr., 1906, ii, 847; Böeseken, Abstr., 1907, ii, 343, 760; and Colson, Abstr., 1908, ii, 273).—From experiments on the specific gravity, heat of combustion, fusion, and vapour pressure of samples of red phosphorus, the authors conclude that only two allotropic modifications of phosphorus exist: white phosphorus and Hittorf's metallic phosphorus. They are to be regarded as dynamic allotropes. Red phosphorus is a solid solution of white phosphorus in the metallic modification, its composition depending on the temperature of formation and other factors. Since the physical constants for red phosphorus given in the literature are not those of an individual substance, they are without scientific significance.

A. J. W.

Solubilities of Orthophosphoric Acid and its Hydrates. A New Hydrate. ALEXANDER SMITH and ALAN W. C. MENZIES (*J. Amer. Chem. Soc.*, 1909, **31**, 1183—1191).—This investigation was undertaken with the object of studying the hydrates of orthophosphoric acid. The method employed consisted in making a series of determinations of the concentrations of saturated solutions in stable equilibrium with the solid phase between −16·3° and 42·3° (the m. p. of orthophosphoric acid). The results show that only two hydrates exist, namely, Joly's hydrate, $2H_3PO_4,H_2O$ (Abstr., 1885, 483), and a new hydrate, $10H_3PO_4,H_2O$. The solubility curves of these hydrates have been constructed. The m. p.'s of Joly's hydrate and orthophosphoric acid have been re-determined, and found to be 29·35° and 42·30° respectively. The vapour pressure of Joly's hydrate is 0·85 mm. at 25°.

The author criticises Giran's work (Abstr., 1908, ii, 685), in which an attempt was made to determine the hydrates formed by the phosphoric acids by measuring the initial f. p.'s of mixtures of water with each acid. It is stated that Giran's failure to discover the new hydrate was due to his method being insufficiently refined. E. G.

Electrical Conductivity and Viscosity of Concentrated Solutions of Orthophosphoric Acid. ALEXANDER SMITH and ALAN W. C. MENZIES (*J. Amer. Chem. Soc.*, 1909, **31**, 1191—1194).—Of the three hydrates of sulphuric acid, only one influences the electrical conductivity. The present work was undertaken to ascertain whether the conductivity of phosphoric acid solutions is similarly related to one or both of the hydrates. The conductivity has been determined at concentrations between 89·7% and 98·8% at 29·30°. The results are tabulated and plotted as a curve, which does not show any tendency to bend at concentrations corresponding with the compositions of the hydrates. Orthophosphoric acid therefore differs from sulphuric acid in this respect. The relative viscosities of solutions of phosphoric acid of concentrations varying from 90·6% to 98·1% were determined at 25°. The curve obtained from the results does not show any marked bend. E. G.

Solubility and Hydrates of Boric Acid. RAFFAELO NASINI and I. AGENO (*Zeitsch. physikal. Chem.*, 1909, **69**, 482—485).—The solubility of boric acid in water has been determined between 0° and 120°. Some of the results, in grams H_3BO_3 in 100 grams of the solution, are as follows: 2·59 at 0°, 4·90 at 21°, 8·02 at 40°, 12·90 at 60°, 19·11 at 80°, 28·10 at 99·5°, 52·4 at 120°. Concordant results could not be obtained at higher temperatures (in sealed tubes) owing to the action of boric acid on glass.

The molecular weight of boric acid in water, as determined by the ebullioscopic method, is normal up to a concentration of 30%.

The formation of lower hydrates of boric acid on heating has been investigated by the dilatometer method. At 107—108°, metaboric acid is formed, and at 138—140°, pyroboric acid. The formation of the former acid has been confirmed by a molecular weight determination by the ebullioscopic method in anhydrous acetic acid; observed value = 38·3, theoretical value 44. G. S.

The Decolorising Properties of Amorphous Carbon. LOUIS PELET-JOLIVET and C. MAZZOLI (*Bull. Soc. chim.*, 1909 [iv], **5**, 1011—1019).—It has been shown previously (Freundlich and Losev, Abstr., 1907, ii, 534, and Pelet and Grand, *Rev. gen. Mat. Col.*, 1907, **11**, 225) that the absorption of colouring matters by charcoal is analogous to the absorption of dyes by textile fabrics and follows the same law.

Glassner and Suida (Abstr., 1907, ii, 932) have suggested that the absorption by charcoal is due to the presence of substances containing cyanogen groups.

In the present investigation, sixteen commercial charcoals of animal and vegetable origin have been compared as regards their decolorising powers for methylene-blue and ponceau dyes, and it was found that there was no relation between the decolorising power of a charcoal and its nitrogen content. Further, purification of the charcoal in various ways made little difference to its decolorising power, due allowance being made for experimental error. T. A. H.

Diamonds in Iron. Bernhard Neumann (*Zeitsch. Elektrochem.*, 1909, 15, 817—820).—An historical account of the investigations concerning the occurrence of diamond in meteoric and technical iron. The "diamonds" which have been observed in the latter are now proved by the work of Otto Johannsen (*Stahl und Eisen*, 1908, 29, 348) to be crystals of corundum. T. E.

Transformation of Diamond into Graphite. Rudolf Vogel and Gustav Tammann (*Zeitsch. physikal. Chem.*, 1909, 69, 598—602. —The experiments were undertaken with the object of finding at what temperature diamond changes to graphite. Most of the observations were made with splinters of Cape diamonds, which were placed in glazed, sealed porcelain tubes, and heated in an electric furnace. At 1000°, the change is exceedingly slow, and may not occur at all; at 1200° a considerable transformation takes place within twenty-four hours, and at 1500° is relatively rapid. A piece of diamond, which was heated at 1600° in fused calcium silicate, so as to exclude air, was also superficially changed to graphite. G. S.

Apparatus for Separating the Inactive Gases from Mixtures by means of the Electric Flame. Ferdinand Henrich (*Zeitsch. Elektrochem.*, 1909, 15, 749—751).—The current from an induction coil (supplied with alternating current at 110 volts and 4 amperes) is passed between thick platinum wire electrodes in a glass tube 3·5 cm. wide. The essential feature of the apparatus is that the tube is drawn out to a conical shape just above the arc, and sealed to a narrow tube through which a solution of sodium hydroxide is continuously supplied. This spreads over the glass in a thin film, cooling it and absorbing the nitrogen peroxide. The solution flows off continuously through a lute at the bottom of the tube. T. E.

Existence of Double Salts, in particular of Carnallite and Schoenite, in Aqueous Solution. Robert Kremann (*Jahrb. K. K. Geol. Reichanstalt*, 1908, 58, 71—78).—The question as to whether the double salts, carnallite and schoenite, are present in aqueous solutions of the respective component simple salts has been examined. In the case of carnallite, the concentrations of solutions of potassium chloride and of sodium chloride were determined, which, according to conductivity measurements, are isohydric with various solutions of magnesium chloride. The fact that the isohydric solutions of potassium chloride are more concentrated than those of sodium chloride is regarded as evidence in favour of the existence of undecomposed carnallite in the more concentrated potassium magnesium chloride solutions. In more dilute solutions, no essential difference between the concentrations of the isohydric potassium and sodium chloride solution is found, indicating that the double salt molecules are more or less completely decomposed.

Similar differences are found when solutions of magnesium and of zinc sulphate are compared with reference to potassium sulphate solutions. The differences in question indicate that the corresponding double salts are unequally stable in aqueous solutions of the same molar concentration. H. M. D.

Monoclinic Modification of Potassium Dichromate. Otto Hauser and H. Herzfeld (*Zeitsch. physikal. Chem.*, 1909, **68**, 175—176).—When hot concentrated solutions of potassium dichromate and of potassium thiocyanate are mixed, the dichromate crystallises on cooling in yellowish-brown, doubly-refracting, monoclinic plates. The density of this form is 2·10, whereas that of the ordinary triclinic variety is 2·67. The monoclinic dichromate is unstable, and is transformed into the triclinic salt when kept in contact with its saturated solution or in moist air. It seems probable that the new form of the potassium salt is isomorphous with monoclinic ammonium dichromate.

H. M. D.

Monoclinic Variety of Sodium Alums. N. I. Surgunoff (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 1057—1065).—A solution of sodium alum, which is supersaturated at 20° or some lower temperature, deposits crystals of the cubic system, but if supersaturation occurs at a temperature higher than 20°, monoclinic crystals,

$$a:b:c = 2{\cdot}5101:1:0{\cdot}9078;\ \beta = 109°1',$$

are deposited. The composition of the monoclinic crystals is found to correspond almost exactly with the formula : $Na_2Al_2(SO_4)_4,22H_2O$.

T. H. P.

Lithium Molybdates. Fritz Ephraim and Max Brand (*Zeitsch. anorg. Chem.*, 1909, **64**, 258—262).—The only lithium molybdate hitherto known, Li_2O,MoO_3, forms white, anhydrous, monoclinic needles, readily soluble in water to an alkaline solution. It does not form isomorphous mixtures with ammonium molybdate. With a slight excess of molybdic acid, slender needles of the *salt*,

$$2Li_2O,3MoO_3,$$

are obtained, and may be recrystallised from water, in which it is rather sparingly soluble. With hydrochloric acid, groups of needles of the *salt*, $Li_2O,2MoO_3,5H_2O$, are obtained, readily soluble in hot water. It loses one-third of its water of crystallisation at 120°, the remainder only at a red heat.

Lithium paramolybdate, $3Li_2O,7MoO_3,28H_2O$, prepared according to the equation :

$$7(Li_2O,MoO_3) + 8HNO_3 = 3Li_2O,7MoO_3 + 8LiNO_3 + 4H_2O,$$

crystallises in readily soluble bundles of needles. The *salt*,

$$Li_2O,3MoO_3,7H_2O,$$

obtained by evaporating a solution of the next salt, removing crystals of molybdic acid, and concentrating further, forms long, slender needles. If fused and ignited in hydrogen, a dark violet, lustrous solid is obtained, resembling the alkali tungsten bronzes.

The *salt*, $Li_2O,4MoO_3,7H_2O$, obtained by boiling lithium carbonate with a large excess of molybdic acid, or according to the equation:

$$4(Li_2O,3MoO_3) + 2HNO_3 = 3(Li_2O,4MoO_3) + 2LiNO_3 + H_2O,$$

forms an amorphous, yellow mass, gradually becoming hard and brittle. Salts containing larger quantities of molybdenum could not be obtained. C. H. D.

Isomorphism of Sulphates, Selenates, and Tellurates. GIOVANNI PELLINI (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 279—282).—From solutions containing various proportions and amounts of rubidium hydrogen selenate and rubidium hydrogen tellurate, the author has obtained mixed crystals containing from 51·55 to 67·46% (mol.) of the selenate. With solutions still richer in the selenate, crystals containing proportions up to 100% of the latter can be obtained. There exists, however, a limit to the proportion of the tellurate in the mixed crystals, since all solutions containing more than about 50% (mol.) of the tellurate deposit the latter in a pure state. The solubility isotherm exhibits all the characters indicative of isodimorphous salts, but no crystallographic measurements have as yet been made of the two salts and the mixed crystals.

With mixed solutions of rubidium hydrogen sulphate and rubidium hydrogen tellurate, most of the results obtained can be interpreted by assuming the formation of a double salt, $RbHTeO_4.RbHSO_4$, but indications are given of a tendency to form mixed crystals.

T. H. P.

Rubidium and Cæsium Hydrogen Carbonates. ROBERT DE FORCRAND (*Compt rend.*, 1909, 149, 719—721. Compare this vol., ii, 730).—Hydrogen carbonates of rubidium and cæsium are prepared from concentrated solutions of the normal carbonates by saturating them with carbon dioxide and drying over phosphoric oxide in an atmosphere of carbon dioxide. The anhydrous hydrogen carbonates are obtained as monoclinic prisms, or, occasionally, in the case of the rubidium salt, long needles. These salts, which are not hygroscopic, are very soluble in water, the rubidium salt requiring 7·02 equivalents of water, and the cæsium salt 5·13 equivalents, for solution at 20°. They are also soluble to the extent of 2% or more in alcohol, in which potassium hydrogen carbonate is nearly insoluble. Rubidium and cæsium hydrogen carbonates, which are more stable than the potassium salt, are unaffected at 125°, and only converted into normal carbonates at 175° in a current of inert gas. The heats of dissolution at 15° are as follows: $KHCO_3$ −5·320 Cal., $RbHCO_3$ −4·731 Cal., $CsHCO_3$ −4·317 Cal. The heats of neutralisation and of formation from the elements are remarkably similar for potassium, rubidium, and cæsium hydrogen carbonates, whereas the sodium salt gives distinctly smaller values. R. J. C.

Rubidium and Cæsium Molybdates. FRITZ EPHRAIM and HEINRICH HERSCHFINKEL (*Zeitsch. anorg. Chem.*, 1909, 64, 263—272. Compare this vol., ii, 1001).—*Rubidium molybdate,* Rb_2O,MoO_3, prepared by dissolving molybdenum trioxide in a warm solution of rubidium hydroxide, evaporating, and washing the deliquescent mass with alcohol, forms white crusts. The *salt*, $Rb_2O,2MoO_3,2H_2O$, obtained on evaporating solutions containing nitric acid, forms readily soluble prisms or plates. A corresponding potassium salt is not known. With a slight excess of nitric acid, a white precipitate of the *salt*, $Rb_2O,4MoO_3,2{\cdot}5H_2O$, insoluble in water, is obtained. If four times the quantity of nitric acid is added, a *salt*,

$$Rb_2O,11MoO_3,5{\cdot}5H_2O,$$

is obtained in pale yellow, microscopic needles on heating. With still larger quantities of nitric acid, the yellow *salts*, $Rb_2O,13MoO_3,4H_2O$ and $Rb_2O,18MoO_3$, are obtained.

By boiling rubidium molybdate with molybdic acid, and crystallising the solution, crystals of the *salt*, $Rb_2O,4MoO_3,0{\cdot}5H_2O$, the *paramolybdate*, $3Rb_2O,7MoO_3.4H_2O$, and the *salts*,

$$4Rb_2O,5MoO_3,12H_2O$$

and $5Rb_2O,7MoO_3,14H_2O$, which may be isomorphous mixtures, are obtained. The paramolybdate is partly decomposed by hot water, giving salts of the approximate composition : $3Rb_2O,8MoO_3,6H_2O$ and $Rb_2O,3MoO_3,6{\cdot}5H_2O$.

Similar cæsium molybdates are obtained, having the formulæ: $Cs_2O,5MoO_3,3H_2O$; $Cs_2O,3MoO_3.H_2O$ (or $3Cs_2O,10MoO_3,3H_2O$) ; $2Cs_2O,5MoO_3,5H_2O$, and $Cs_2O,16MoO_3,8H_2O$. C. H. D.

The Action of Ozone on Metals and the Cause of Passivity. WILHELM MANCHOT (*Ber.*, 1909, 42, 3942—3948. Compare Manchot and Kampschulte, Abstr., 1907, ii, 616).—The author's previous investigations have shown that silver only reacts with ozone in the cold when a small quantity of oxide, either chemically deposited or mechanically attached, is present. The action of cold 3% ozone is a sensitive means of detecting a film of oxide in silver and other metals. Silver is shown to form a thin film of oxide in air at 200°. A plate of silver, heated in this way or dipped in concentrated nitric acid and washed, is anodic to clean untreated silver.

Passivity is due to the formation of a thin film of oxide. The gradual spontaneous disappearance of the passivity, which has been considered to be inconsistent with the oxide hypothesis, is due to the mechanical flaking-off of the film. This process can be observed in the case of mercury at 55°.

Cadmium, iron, copper, and zinc react with oxygen at a temperature only slightly above that at which they react with ozone. Tin reacts readily with ozone at 500°, and nickel at 415°. Lead at 227° reacts like silver at 240°. Lead and iron, rendered passive by immersion in nitric acid and well washed, react almost instantaneously with ozone in the cold, and the same is observed with iron rendered passive by being made the anode in dilute sulphuric acid.

C. H. D.

Solubility of Hydrogen and Oxygen in Solid and Fused Silver. ADOLF SIEVERTS and JOH. HAGENACKER (*Zeitsch. physikal Chem.*, 1909, 68, 115—128. Compare Abstr., 1907, ii, 741).—The measurements were made in an apparatus consisting essentially of a porcelain tube (containing the silver) connected to a manometer and to a tube for removing or admitting gases; the porcelain tube was electrically heated when necessary.

Hydrogen is not absorbed either by solid or fused silver.

Solid silver absorbs very little oxygen, but when the metal is fused, absorption is rapid, and equilibrium is reached in about fifteen minutes. One volume of silver absorbs 20·3 volumes of oxygen at 973° under 760 mm. oxygen pressure, and 17·56 volumes at 1125°, the amount diminishing regularly with increased temperature. As regards the relationship between the pressure, p, and the amount, m, of oxygen absorbed, the equation $\sqrt{p}/m = \text{constant}$ holds approximately. Henry's law, therefore, does not apply to the solubility of oxygen in fused silver; when the pressure is reduced to one-fourth of its value, the amount of gas absorbed is reduced to one-half. G. S.

Action of Heat on Silver Sulphite and its Alkali Double Sulphites. Formation of a Dithionate. HENRI BAUBIGNY (*Compt. rend.*, 1909, 149, 735—737).—Silver sulphite is said to be decomposed by boiling water into silver sulphate, sulphur dioxide, and metallic silver, but in presence of excess of alkali sulphite, the whole of the silver is precipitated. The author shows that only a small proportion of the silver sulphite is decomposed in this way, more than 80% being converted into dithionate: $2Ag_2SO_3 \rightarrow Ag_2S_2O_6 + 2Ag$, and it is only at a much higher temperature that sulphate and sulphur dioxide are produced from the dithionate. Double sulphites are converted almost quantitatively (95%) into dithionates: $2AgNaSO_3 \rightarrow Na_2S_2O_6 + 2Ag$, and the whole of the silver is precipitated. After precipitating any excess of alkali sulphite by barium chloride, only a slight odour of sulphur dioxide can be detected, but the solution then contains barium dithionate.

The formation of dithionates from sulphites is analogous to the formation of trithionates from the double thiosulphates of alkali and heavy metals (Spring, this Journ., 1875, 129). R. J. C.

Volatility of the Bromides of Radium, Barium, Strontium, and Calcium. ALFRED STOCK and HANS HEYNEMANN (*Ber.*, 1909, 42, 4088—4093).—Experiments have been made to see if radium bromide could be conveniently separated from barium bromide by fractional sublimation. The substance to be investigated was gradually heated in a quartz tube, and the temperature noticed at which a definite deposit was formed on the cold part of the tube. These sublimation temperatures could be sharply determined in the case of the bromides of calcium, strontium, and barium; they were respectively 720°, 770°, and 820°. Barium bromides containing 1/1000, 1/100, and 6% respectively of radium bromide were then investigated; the sublimates formed were collected while the tube was heated to about 900° for some hours. A first and smaller sublimate was generally collected, and then a second larger one.

It was found (1) that radium bromide is less volatile than barium bromide; (2) that by fractional sublimation the residue becomes richer in radium. The radium concentrations in the residue and sublimate are all the more different the smaller the quantity of the latter. T. S. P.

Preparation of Compounds containing Active Oxygen. Emanuel Merck (D.R.-P. 213457).—When the alkali hydrogen sulphates, or hydrogen carbonates, are treated in aqueous solution with the alkaline earth peroxides, or perhydroxides, the corresponding *peroxysulphates* or *peroxycarbonates* are formed, as represented by the equation: $Ba(OH)_4 + 2NaHCO_3 = BaCO_3 + Na_2CO_4 + 3H_2O$. F. M. G. M.

Loss [of Weight] of Heavy Spar on Heating. Wilhelm Vaubel (*Chem. Zeit.*, 1909, 33, 1121—1122).—Barium sulphate shows a loss of weight when heated for an hour in the Bunsen flame. The resulting product is alkaline, and contains an appreciable quantity of barium sulphide. It has been found that certain heavy spars lose from 0·5 to 0·7% in weight on heating, and a portion of this has been traced to the evolution of carbon dioxide. H. M. D.

Solutions of Lime and Silica in Fused Calcium Chloride. Kurt Arndt and Willi Loewenstein (*Zeitsch. Elektrochem.*, 1909, 15, 784—790).—Between 860° and 940°, 100 grams of calcium chloride dissolve 16·2 grams of calcium oxide. Silica dissolves slowly, chlorine being evolved and calcium orthosilicate formed. The percentages of silica in the saturated solutions are at 800°, 2·5; 850°, 3·8; 900°, 5·4; 950°, 7·6. When a solution of lime in calcium chloride is fused in a porcelain tube, it dissolves nearly one molecule of silica for two molecules of lime in solution. The conductivities of several solutions of this kind are measured; the results are in harmony with the view that the calcium orthosilicate and lime in solution diminish the conductivity of the calcium chloride independently and in proportion to their quantity. From the measurements, the specific conductivity of pure calcium chloride is extrapolated; it is at 800°, 2·10; 850°, 2·27; 900°, 2·40; 950°, 2·51. The densities of solutions of lime in calcium chloride are also determined; the density increases by 0·009 for each 1% of dissolved calcium oxide; the density of pure calcium chloride is at 800°, 2·048; 850°, 2·026; 900°, 2·002. One per cent. of calcium orthosilicate increases the density by 0·012. The equivalent conductivity of calcium chloride is calculated from these data. T. E.

Permeability of Glass to Vapours. Hans Landolt (*Zeitsch. physikal. Chem.*, 1909, 68, 169—174).—On the basis of experiments which appeared to indicate that many gases and vapours can pass through glass at the ordinary temperature, Zengelis (this vol., ii, 134) has suggested that Landolt's experiments, relating to the total weight of substances before and after chemical reaction, afford evidence of a real loss of weight in certain cases. To test the possibility of the correctness of this view, the author has made experiments with solutions of silver sulphate and ferrous sulphate, and with solutions of hydriodic and iodic acids, under conditions similar to those employed by Zengelis. Samples of the same glass as that used in the weight experiments were employed, but entirely negative results were obtained. With sealed vessels of thinner glass, the results were also negative. As a result of these measurements, the explanation previously given (Abstr., 1908, ii, 366) of the observed small changes in weight of the above-mentioned substances on reaction requires no modification. The fact that the changes were found to be smaller in vessels which were covered on the inside with a layer of paraffin, is attributed to the low thermal conductivity of the paraffin layer.

H. M. D.

Zinc Alloys. B. E. Curry (*J. Physical Chem.*, 1909, 13, 589—605).—The work of Mönkemeyer (Abstr., 1905, ii, 171) and Schemtschuschny (Abstr., 1906, ii, 549) on the freezing-point curve of zinc-antimony alloys indicated the existence of two compounds, ZnSb and Zn_3Sb_2, and of three eutectic mixtures. An inversion point was noticed in the cooling curves of all alloys between Zn_3Sb_2 and pure Zn. This point, about 321° in Mönkemeyer's experiments, was supposed to indicate an allotropic form of zinc, but Schemtschuschny showed that the inversion was in the alloy Zn_3Sb_2. It is now shown that considerable errors due to supercooling were present in the experiments referred to. The author's experiments were made on the heating, instead of cooling, curves of well annealed ingots.

The curve obtained exhibits only one maximum and two eutectics. The compound ZnSb (35% Zn) is confirmed. Both microscopical and thermal data disprove the formation of a compound Zn_3Sb_2. A solid solution of the alloy ZnSb and zinc begins to appear above 35% zinc. Alloys from 40% to 45% of zinc are homogeneous whether chill cast or annealed, and consist of crystals of solid solution. Beyond 45% the solid solution crystals are mixed with crystals of zinc. The solid solution shows a maximum melting point, 565°, at 45%.

The heating curves of all alloys containing the solid solution exhibit, not one, but two inversion temperatures. The solid solution therefore exists in three forms: α, β, and γ. In presence of zinc, that is, in alloys containing more than 45% of zinc, γ is transformed into β at 405°, and β into α at 437°. In presence of the compound SbZn, that is, in alloys containing 35—40% of zinc, the transformation temperatures are 485° and 500° respectively. In solid solutions containing 40—45% of zinc, crystallising homogeneously, the transformation temperatures are intermediate and vary with the composition. The one inversion point noticed by Mönkemeyer and Schemtschuschny is more than 70° too low, owing to supercooling. The freezing-point curve cuts the transformation curve of β into α (437°) at 95% of zinc, so that between 95% and 100% of zinc no α is formed from the melt.

The eutectic mixture at 97·5% of zinc, solidifying at 411°, that is, above the transformation temperature of γ into β, consists of β and pure zinc. No microscopic difference can be detected between α, β, and γ, the evidence for which is entirely thermal. The compound ZnSb does not form solid solutions with antimony.

Alloys of zinc with tin contain no compounds, the only two phases being pure zinc and a solid solution of zinc in tin containing up to 5% of zinc if chill cast or 7% after annealing at 180°.

Zinc cadmium alloys give a similar curve, but the phases are two series of solid solutions of zinc in cadmium and of cadmium in zinc, containing upwards of 4% and 5% of solute respectively after annealing at 217°.

The miscibility of zinc with lead and of zinc with bismuth is very slight. Practically pure lead and zinc separate from all mixtures of the two, distinct layers being formed. The liquid phases become more miscible as the temperature rises, until near 920° the liquid is homogeneous.

Mixtures of zinc and bismuth deposit two phases, namely, pure zinc and a solid solution of zinc in bismuth, containing upwards of 4%. The melted mixture becomes homogeneous at 820°. R. J. C.

Action of Carbon and Silicon on Zinc Sulphide at High Temperatures. Walter Fraenkel (*Metallurgie*, 1909, 6, 682—688).—Mixtures of zinc sulphide and carbon are known to volatilise at high temperatures. When the mixture is heated in a quartz vessel to 1300—1400° in an atmosphere of nitrogen, a volatile product is obtained, containing zinc, carbon, and sulphur, which reacts with the silica of the enclosing vessel. The product is also volatile, and corresponds approximately with the composition ZnSSi. Using a carbon lining to the tube, the vapours nevertheless penetrate to the quartz, and introduce silicon into the mixture.

The *compound*, ZnSSi, is also obtained by heating zinc sulphide to 1300° with silicon. It condenses to hard, brown crusts. With acids the sulphur is evolved quantitatively as hydrogen sulphide, and with aqueous alkalis, hydrogen is evolved. It may be polished like a metal, and is microscopically homogeneous. The electrical conductivity is less than that of silicon. C. H. D.

Carbonates of Some Heavy Metals. Karl Feist (*Arch. Pharm.*, 1909, 247, 439—447).—The preparation of pure basic carbonates of metals such as zinc is a very tedious operation, owing to the difficulty of washing the voluminous precipitates produced when solutions of the salts are precipitated with sodium carbonate. This difficulty is met by grinding the crystalline salt of the heavy metal with a slight excess of crystallised sodium carbonate until no more carbon dioxide is evolved and the whole mass has become liquid. Water is then added, the precipitate washed by decantation, since it readily settles, and dried.

Zinc sulphate gave a basic carbonate having the composition $1H_2O,1{\cdot}03CO_2,2{\cdot}15ZnO$, which agrees approximately with the formula $ZnCO_3,Zn(OH)_2$. In only one case was a good result obtained with copper sulphate, the precipitate generally retaining basic sulphate. With lead nitrate or acetate a basic carbonate intermediate in composition between that of the normal carbonate and that of white lead was produced. Aluminium sulphate gave a precipitate which contained a basic sulphate and also a basic carbonate, which could not be removed by washing. With ferric chloride ($FeCl_3,12H_2O$) a neutral dark brown powder was obtained, which dissolved in acids with evolution of carbon dioxide. The composition was

$$1CO_2,7{\cdot}7H_2O,6{\cdot}8Fe_2O_3.$$

Continued washing with water gradually removed the basic carbonate, because of hydrolysis, and then the precipitate no longer settled rapidly. T. S. P.

Metastability of the Metallic World. Ernst Cohen and Katsuji Inouye (*Chem. Weekblad*, 1909, 6, 881—892. Compare Cohen, Abstr., 1908, ii, 858).—Metals in ordinary use are in a metastable condition, and can be changed into a more stable state, not only by rise of temperature, but also by inoculation. When a strip of lead having a cross etched on its surface by the action of 50% nitric acid for thirty minutes, is kept in contact under pressure with a similar unetched lead strip at 180° for seventeen hours, the cross is found to be developed on the second strip. Similar results can be obtained by inoculating zinc with zinc, brass with brass and copper, copper with copper, and bismuth with bismuth, the extent of the inoculation depending on the nature of the metallic substances and the experimental conditions. The temperatures employed by the authors were 100° and 180°, and the duration of the experiments varied between seventeen and forty-eight hours. Contact under pressure at ordinary temperatures does not induce the inoculation. All the metals and alloys employed in the experiments had been rolled out in strips, and therefore had been submitted to severe mechanical strain.

The decay of lamp reservoirs made of rolled brass, stamped out to the required form, as well as that of door handles and other metallic objects, is attributed by the authors to a tendency to pass into a more stable condition. The appearance of the corroded parts, viewed through the microscope, is similar to that of the metal after etching, whilst that of the sound portions resembles the appearance of freshly-rolled brass. A. J. W.

New Method for Determining the Composition of Mixed Crystals Deposited by Alloys at Different Temperatures. Domenico Mazzotto (*Nuovo Cim.*, 1909, [v], 18, ii, 180—196).—This method, which is based on a knowledge of the heats of fusion developed when the mixed crystals solidify, may be used for determining the compositions of the mixed crystals separating, not only at the eutectic point, but also at higher temperatures. If an alloy of two metals, A and B, having the composition a, begins to solidify at the temperature t, higher than the eutectic temperature, and if also the concentration a_1 corresponds with some lower temperature t_1, and p be the weight of the crystals deposited between the temperatures t and t_1, then unit weight of the alloy may be divided into two parts: (1) a weight p of crystals of unknown composition a_m, and (2) a weight $1-p$ of liquid alloy of composition a_1. The weight of the component A contained in the crystals (1) will be pa_2, and in the liquid portion $(1-p)a_1$, so that $pa_2+(1-p)a_1=a$ or $a_2=(a-a_1)/p+a_1$. The value of p is given by the formula $p=Q/c$, where Q represents the number of calories developed in the partial solidification occurring between the temperatures t and t_1 and c the mean heat of fusion of the solid deposited, which can be determined by the formula $c=(c_2-Q_1)/(1-Q_1/c_1)$, Q_1 being the heat developed by solidification of the alloy down to the eutectic point, c_1 the heat of fusion of the eutectic alloy, and c_2 the total heat of fusion of the alloy. If a_2 is found to have the value 0, it is evident that the component B is deposited in the pure state from alloys which, with respect to the eutectic, have an excess of B, whilst if $a_2=1$, the pure component A is deposited from alloys containing excess of A. In the case in which the alloy solidifies completely above the eutectic point, Q would have the value zero and $c=c_2$. The case when t_1 corresponds with the eutectic temperature is discussed with the help of a construction similar to that employed by Tammann (Abstr., 1904, ii, 113; 1905, ii, 444) in the thermal analysis of crystallised chemical compounds, the ordinates representing, not the duration of the arrest of the thermometer at the eutectic point, but the heats developed by the solidification of the separate alloys down to the eutectic point.

The method is applied to the following binary alloys: (1) Lead and tin; the results obtained are in good agreement with those of Rosenhain and Tucker (Abstr., 1908, ii, 1038). (2) Tin and zinc.—Here the values of c for alloys containing excess of tin ($a=0·952$ or $0·941$) or excess of zinc are higher than the respective heats of fusion of pure tin and zinc; this phenomenon is probably connected with the large amount of heat absorbed in the formation of these alloys. The alloys rich in zinc deposit pure zinc, and those rich in tin, pure tin. (3) Tin and bismuth.—The results here indicate that the mixed crystals at the eutectic point contain 16% of bismuth. Alloys with excess of bismuth (a for tin $=0·200$ and $0·111$) deposit either pure bismuth or crystals containing a very small proportion of tin. (4). Bismuth and lead.—In this case the values of c for alloys containing excess of bismuth differ little from the heat of fusion of this metal, but for other alloys, for instance, the eutectic, the values of c are very low compared with those for the two components; this behaviour is doubtless related to the large amount of heat developed in the formation of these alloys. The alloys with excess of bismuth deposit this metal in a sensibly pure state, but with those containing excess of lead, mixed crystals containing proportions of bismuth varying up to a maximum of 38—39% are deposited. T. H. P.

Two Lead Silicates. Hermon C. Cooper, L. I. Shaw, and N. E. Loomis (*Ber.*, 1909, 42, 3991—3993; *Amer. Chem. J.*, 1909, 42, 461—473. Compare this vol., ii, 890).—A number of mixtures of lead oxide and finely-powdered quartz, in which the proportions varied from 100 to 43 equivalents % of lead oxide, have been investigated. In order to obtain an uniform composition, the mixtures were melted, then cooled, and the solid finely-powdered, again melted, slowly cooled, and powdered; the resulting powder could then be used for the investigation proper. This method of procedure was necessary, since no conclusions could be drawn from the cooling curves owing to the large amount of supercooling. The heating curves were therefore taken, and the results obtained point to the existence of two lead silicates, namely, the ortho-silicate, Pb_2SiO_4, melting at 746°, and the meta-silicate, $PbSiO_3$, melting at 766°. Lead oxide was found to melt at 888°.

When quickly cooled, all fusions containing less than 80 equivalents % of lead oxide give clear, coloured glasses. When slowly cooled, all fusions containing more than 60 equivalents % of lead oxide crystallise completely; those which are richer in silica crystallise only in part, but if the resulting solid is finely powdered and heated for several hours to a temperature which is 10—100° lower than the melting point, a sintered, crystalline mass is obtained.

T. S. P.

Co-precipitation of Thallium Sulphide with other Sulphides.

Ludwik Bruner and J. Zawadski (*Bull. Acad. Sci. Cracow*, 1909, 312—321).—If thallium is precipitated as sulphide from solutions containing other metals, the value of the constant $k=[\mathrm{Tl}^{\cdot}]^2[\mathrm{H_2S}]/[\mathrm{H}^{\cdot}]^2$ will be affected if sulphides of the other metals are precipitated along with the thallium. The relation between the value of the constant and the molar composition of the precipitate will give information as to the nature of the precipitate.

Qualitative experiments showed that besides the sulphides of the arsenic sub-group, the sulphides of mercury and copper are thrown down together with thallium from acid solutions; lead and cadmium sulphides do not carry down thallium sulphide with them. Quantitative experiments were made in the presence of arsenic and copper salts, the equilibria being determined from both sides as follows: Solutions containing thallium sulphate and either arsenious oxide or copper sulphate were treated at 25° with hydrogen sulphide, or else the precipitate so obtained was treated with sulphuric acid in a current of hydrogen sulphide. Equilibrium is attained only after a very long time, in some cases only after two or three months.

Arsenious sulphide forms a series of solid solutions with thallium sulphide from pure arsenious sulphide to 73·5 mols. % of thallium sulphide. Above 73·5 mols. % the normal value for the equilibrium constant is obtained, and the precipitate can be seen to contain two phases, namely, black, crystalline thallium sulphide and a brown, solid solution of arsenious and thallium sulphides.

Cupric sulphide forms a compound, $Tl_2S,4CuS$, with thallium sulphide, and over the interval 20—36 mols. % of thallium sulphide it forms a series of solid solutions which are best explained as being solutions of $Tl_2S,2CuS$ in $Tl_2S,4CuS$, and of Tl_2S in $Tl_2S,2CuS$. At concentrations of more than 36 mols. %, normal values of the equilibrium constant are obtained; there are then two solid phases, consisting of thallium sulphide and probably a solid solution of thallium sulphide in the compound $Tl_2S,2CuS$.

T. S. P.

The Occurrence of Copper in the Stassfurt Potash Deposits. WILHELM BILTZ and E. MARCUS (*Zeitsch. anorg. Chem.*, 1909, 64, 236—244).—The 'samples of potash deposits recently examined for the presence of ammonia and nitrates (this vol , ii, 571) have now been tested for copper, which has been proved to exist in sea-water.

Copper sulphide is soluble in concentrated solutions of sodium chloride. For rock-salt specimens, therefore, 200 grams are dissolved in 650 c.c. of water, and the bulk of the salt precipitated by hydrogen chloride; the copper is precipitated from the filtrate by hydrogen sulphide, reprecipitated, and ultimately estimated colorimetrically with potassium ferricyanide. Carnallite may be precipitated directly with hydrogen sulphide, as it does not retain copper sulphide in solution. Salt-clay and anhydrite must be extracted with a mixture of one part hydrochloric acid and 5 parts nitric acid. The clay probably contains copper as sulphide.

The quantity of copper ranges from 0·10 mg. in 200 grams rock salt to 1·32 mg. in salt-clay. The anhydride veins are slightly richer than the neighbouring salt.

The adsorption of copper sulphate by salt-clay and fire-clay has been measured. The former has three times as great a capacity for adsorbing copper as the latter. C. H. D.

Transformation Points of Copper-Aluminium Alloys. Variation of Electrical Resistance with Temperature. MAURICE BARRÉE (*Compt. rend.*, 1909, 149, 678—681. Compare Guillet, Abstr., 1905, ii, 712).—The tempering of aluminium bronzes containing 8 to 16% of aluminium has been shown to depend on transformations which occur at about 500° and 750°, although there is some disagreement as to the actual temperatures. The author has measured the electrical resistance of thick bars of two alloys containing 9% and 12% of aluminium. The bars were heated in an Heraeus resistance furnace, a vacuum being maintained to prevent oxidation, and the temperature being measured by a Le Chatelier couple. Transition points were found at roughly 200°, 500°, and 750°. The alloys were not uniform in composition, and the impurities such as iron, silicon, etc., were irregularly distributed, so that the transition points in every sample were different. The changes are reversible, but in every case the retransformation on cooling takes place at a lower temperature. Continual heating and cooling do not alter the transformation temperatures, but render them sharper, owing to the increase in homogeneity which occurs. Liquation is also an important factor.

R. J. C.

Ammoniacal Solutions of Cupric Hydroxide. HARRY M. DAWSON (*Zeitsch. physikal. Chem.*, 1909, 69, 110—122).—The nature of the complex present in ammoniacal solutions of cupric hydroxide has been investigated by solubility and distribution measurements, as well as by electrical conductivity measurements. The results appear to indicate that the copper is present in the form of the compound $Cu(NH_3)_4(OH)_2$, a moderately strong base.

The cupric hydroxide was prepared by adding ammonia to a boiling solution of cupric sulphate until the supernatant liquid begins to turn blue; the precipitated basic salt, after washing, is treated with sodium hydroxide, and the resulting bright blue, crystalline hydroxide washed and dried. The product thus obtained appears to be a definite modification of the hydroxide. Solubility measurements were made at 18° in solutions containing from 0·20 to 10 mols. of ammonia per litre. A formula for calculating the results is deduced, and good constants are obtained for solutions containing 1 to 8 mols. of ammonia per litre on the assumption that the copper is associated with $4NH_3$. The "constants" in very dilute and very concentrated solutions are somewhat smaller than the normal value on the above assumption as to the nature of the complex, but for this plausible explanations have been found. The experimental results are not in agreement with those of Bonsdorff (Abstr., 1904, ii, 733), and it is suggested that the solutions used by the latter were supersaturated.

The variation of the electrical conductivity of ammoniacal cupric hydroxide solutions with the ammonia concentration has been measured and compared with the results obtained for ammoniacal solutions of barium hydroxide, piperidinium hydroxide, copper sulphate, and sodium sulphate in equivalent concentration. All the curves in which the conductivities are plotted as ordinates against the ammonia concentrations as abscissæ show maxima at different ammonia concentrations in each case. No very definite conclusions can be drawn from the results; they are not incompatible with the assumption that the ammoniacal cupric hydroxide solution contains one and the same base, independent of the ammonia concentration.

Measurements of the distribution of ammonia between the solutions in question and chloroform have been made at 18°, but the results are not very conclusive, owing to the fact that the ratio of total ammonia to copper is of the order 100 : 1, and that the correction to be applied for the salting-out effect of the cuprammonia hydroxide on the ammonia is somewhat uncertain. On the whole, the results support the view that the ratio of combined ammonia to copper is 4 : 1.

G. S.

The System Cu_2S FeS. KARL BORNEMANN and F. SCHREYER (*Metallurgie*, 1909, 6, 619—630).—Mixtures of the synthetic sulphides are heated in a fire-clay crucible with a thin lining of Marquardt mass in an atmosphere of nitrogen. In most cases some copper is set free during cooling. The freezing-point curve is complicated, and is considered to indicate the existence of three compounds, $2Cu_2S,FeS$, $3Cu_2S,2FeS$, and $2Cu_2S,5FeS$, the formula of the last being uncertain. Only the first of these is stable at all temperatures below the freezing point. The compound $2Cu_2S,5FeS$ undergoes a transformation at 915°, and breaks up between 500° and 600° into $2Cu_2S,FeS$ and FeS. The compound $3Cu_2S,2FeS$ undergoes a change at 180—230°, metallic copper being set free, the other product of the reaction being a compound rich in sulphur, probably FeS_2, forming solid solutions with the undecomposed compound. Attempts to inhibit the reactions by quenching failed in all cases.

Both the microscopical and thermal methods of investigation were used. C. H. D.

Cuprous Sulphites of Étard and of Rogojski. Ludwig Ramberg (*Zeitsch. physikal. Chem.*, 1909, 69, 512—522).—As there is some difference of opinion as to the purity and even the existence of the cuprous sulphites described by Étard (Abstr., 1882, 1165) and Rogojski (*J. pr. Chem.*, 1851, 53, 409) respectively, these salts have been prepared and examined by the author.

Étard's salt was prepared by boiling 50 c.c. of a 65% solution of acetic acid with powdered copper acetate until the solution is saturated; the clear liquid is decanted, and a brisk stream of sulphur dioxide passed through it for five to seven minutes in a special apparatus kept in boiling water. The liquid quickly becomes deep blue and the sulphite separates in the form of small, lustrous, light amber-coloured plates; formula, $Cu_2SO_3,\frac{1}{2}H_2O$. The yield is about 90% of the calculated value.

Cuprous acetate, first prepared pure by Péchard (Abstr., 1903, ii, 293), has also been obtained by the action of sulphur dioxide on the solution of cupric acetate in acetic acid prepared as above.

Rogojski's salt was prepared by adding 5 grams of ammonium cuprous sulphite, $Cu_2(NH_4)_2(SO_3)_2$ to an almost saturated, aqueous solution of sulphurous acid, and then passing a slow stream of sulphur dioxide through the solution. After six hours, the colourless crystals at first obtained are completely changed to red, prismatic crystals of the composition Cu_2SO_3,H_2O. The salt obtained in this way is not quite pure, but is obtained pure by digesting Étard's salt with an aqueous solution of sulphurous acid in the absence of air.

The constitution of the two salts has not yet been elucidated.

G. S.

Atomic Weight of Mercury. C. W. Easley (*J. Amer. Chem. Soc.*, 1909, 31, 1207—1218).—The atomic weight of mercury has been determined by the analysis of pure mercuric chloride. In order to determine the ratio $HgCl_2 : Hg$, the mercury was estimated in the following manner. A known weight of mercuric chloride was dissolved in water, sodium hydroxide was added in slight excess of the amount required to precipitate the mercuric oxide, and hydrogen peroxide was gradually added until all the oxide had been reduced to the metal. On applying heat, the mercury collected into a globule with the exception of a small quantity which remained in a finely divided state. The globule of mercury was washed repeatedly with water and afterwards with acetone, and dried in a current of air. The finely divided mercury was collected on a small filter, which was afterwards treated with nitric acid and heated on the steam-bath, bromine being added to ensure the complete conversion of the mercury into mercuric salt. The solution was then diluted and boiled to eliminate the excess of bromine, and was treated with hydrogen sulphide in order to precipitate the mercury as mercuric sulphide. The sulphide was collected on a small filter, and the latter was placed in a platinum crucible and covered with water acidified with hydrochloric acid. By the use of a cathode of gold foil, the mercury was deposited and could be weighed, the weight thus obtained being added to that of the mercury globule. From the results of four experiments, the average value for the atomic weight of mercury was found to be 200·48 ($Cl = 35·46$).

In estimating the chlorine in mercuric chloride, the mercury was first removed by the method already described. The filtrate and washings containing the chlorine were acidified with nitric acid. A weighed amount of pure silver was dissolved in nitric acid, and, after being heated to expel nitrous fumes, was diluted to about *N*/10 concentration and added to the solution containing the chlorine. The silver chloride was carefully collected and washed, and the small quantity dissolved in the filtrate and washings was estimated by means of the nephelometer. The average of six experiments gave the atomic weight of mercury, calculated from the ratio $HgCl_2 : 2AgCl$, as 200·62 ($Cl = 35·46$, $Ag = 107·88$). This value is regarded as more accurate than that obtained from the first series of experiments, and is 0·3 higher than the value at present accepted. E. G.

Potassium Mercuri-iodide. J. Höfle and G. Vervuert (*Centr. Min.*, 1909, 554—555).—The following alteration in Goldschmidt's method for preparing Thoulet's solution is described. Mercuric iodide and the minimum necessary quantity of water are triturated to a thick paste, care being taken to avoid the formation of lumps. The requisite quantity of powdered potassium iodide is then added in small quantities at a time, stirring meanwhile. Solution takes place rapidly, and a clear liquid is obtained, from which the excess of water is removed by evaporation on the water-bath to incipient crystallisation. The resulting solution has a density greater than 3·220, but it does not remain constant; it may be taken as 3·22, however. The potassium mercuri-iodide can be obtained from the solution in the form of yellow crystals. When heated with water, mercuric iodide is deposited at first, but it readily dissolves in the resulting solution.

T. S. P.

Compounds of Selenium and of Tellurium with Mercury. Giovanni Pellini (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 211—217).—[With R. Sacerdoti.]—At the ordinary pressure, combination of mercury and selenium under the action of heat takes place slowly, the presence of excess of selenium being requisite; this can only be separated from the crystalline compound, HgSe, by slow fractional distillation. When the two elements are mixed in atomic proportions, complete combination occurs only in a sealed tube, the whole of which must be heated at 550—600° for some time. The pasty, amalgam-like masses obtained on triturating mercury and selenium in a mortar consist of mixtures of mercury and mercuric selenides. At 500—550°, a mixture of the two elements containing 98, 95, 90, 80, or 70 atom % of selenium undergoes partial fusion, and on cooling the mass the thermometer exhibits, in all cases, one resting stage at 132—139°. The fusion curves for the same mixtures show a thermometric stoppage at 216—218°, the m. p. of pure selenium being 220°. The conclusion is drawn that mercuric selenide dissolves very slightly in selenium, even at a high temperature. The temperature halt of the fusion curves corresponds with the eutectic Se + HgSe, whilst that of the freezing curves is due to the rapid transformation of the superfused selenium into the stable, grey modification.

[With C. AUREGGI.]—Mixtures of mercury and powdered tellurium react readily on heating with development of a considerable amount of heat. When 66 atom % or more of tellurium is present, the mixture fuses completely, whilst mixtures less rich in tellurium decompose at a high temperature with liberation of mercury. The solidification curves of mixtures containing from 60 to 95 atom % of tellurium exhibit a eutectic temperature halt at about 410°. The form of the curves indicates the existence of a mercuric telluride, HgTe, which, however, melts with decomposition at the ordinary pressure, its upper limit of stability being about 550°. The eutectic Te + HgTe corresponds with 87 atom % of tellurium, and has a distinctly crystalline appearance. Tellurium dissolves only slightly in mercury. When triturated in a mortar at the ordinary temperature, mercury and tellurium yield a greyish-white paste with a metallic lustre, from which, after a long time, or by gently heating, the compound HgTe may be isolated. T. H. P.

Solubility of Aluminium Hydroxide in Solutions of Aluminium Sulphate and Artificial Production of Alumian. ROBERT KREMANN and K. HÜTTINGER (*Jahrb. K. K. Reichsanstalt*, 1908, **58**, 637—658).—Aluminium hydroxide is only slightly soluble in very concentrated solutions of aluminium sulphate. As the concentration of this diminishes, the solubility increases, and attains a maximum, which at 20°, 40°, and 60° corresponds respectively with solutions containing 32, 28, and 38% of aluminium sulphate. With further diminution of the concentration of the sulphate, the solubility of the hydroxide decreases. The solubility curve shows a break at points corresponding with 8·5% aluminium sulphate at 20°, and with 7 5% at 40° and 60°.

Crystallisation experiments have shown that the solid phases which correspond with the three parts of the solubility curve are respectively: $Al_2(SO_4)_3,16H_2O$; alumian, $Al_2O(SO_4)_2,12H_2O$, and in the case of the more dilute aluminium sulphate solutions, a salt more basic than alumian.

From observations of the rate of decomposition of methyl acetate in corresponding solutions of normal aluminium sulphate and the basic salt alumian, it appears that the latter is hydrolysed to a greater extent than the former.

Measurements of the vapour tension of the partly dehydrated normal and basic salts indicate that normal aluminium sulphate forms hydrates with $2H_2O$ and $12H_2O$, as well as with $16H_2O$ and $18H_2O$, and that the basic salt forms hydrates with $10H_2O$ and $11H_2O$, as well as with $12H_2O$. H. M. D.

Binary Systems of Alumina with Silica, Lime, and Magnesia. EARNEST S. SHEPHERD, GEORGE A. RANKIN, and FRED. EUGENE WRIGHT (*Amer. J. Sci.*, 1909, [iv], 28, 293—333).—Only one compound of alumina and silica is stable in contact with the fused mass; this is the mineral sillimanite, Al_2SiO_5. The minerals andalusite and cyanite of this same composition were not produced artificially; they pass slowly into sillimanite when heated above 1300°.

Of lime and alumina there are four definite compounds:

$3CaO,Al_2O_3$ (m. p. $< 1550°$); $5CaO,3Al_2O_3$ (m. p. 1387°);
CaO,Al_2O_3 (m. p. 1587°); $3CaO,5Al_2O_3$ (m. p. $< 1725°$).

The first and last of these have no true m. p., but they are completely liquid at the temperatures quoted. A second unstable form of each of the compounds $5CaO,3Al_2O_3$ and $3CaO,5Al_2O_3$ is recognised.

There is only one compound of magnesia and alumina, namely, MgO,Al_2O_3 (artificial spinel).

The system MgO–CaO appears to be a eutectic series with no compound and little, if any, solid solution. Here the temperature ranges are too high for satisfactory investigation.

The optical characters of the above-mentioned compounds, and also those of lime and alumina (artificial corundum), are described in detail. The products are in all cases extremely fine grained. L. J. S.

Hydrolysis of Salts of the Cations Al''' and Cr'''. G. Povarnin (*J. Russ. Phys. Chem. Soc.*, 1909, **41**, 1014—1033).—The author has devised an apparatus for determining the degree of hydrolysis of a salt in solution by measuring the p. d. in an element consisting of the salt solution, with and without the addition of the anion of the salt, hydrogen-platinum electrodes being employed. The salts used in the experiments described were aluminium, chromic, and sodium sulphates and sodium chloride. The results of the measurements made lead to the following conclusions.

The retardation of the hydrolysis of aluminium and chromic sulphates produced by the ion SO_4'' is greater than that caused by $2Cl'$. Hence these sulphates, in presence of the ions of an univalent metal ($Na^{\cdot}$), are hydrolysed to a less degree than are the corresponding chlorides. In general, chromic sulphate is somewhat more strongly dehydrolysed by the ions SO_4'' and Cl' than is aluminium sulphate. For the concentrations $v_{33}-v_{51}$, chromic sulphate is hydrolysed to less extent than aluminium sulphate, which is opposed to what was found for the chlorides of these metals at the concentration v_{32} by Bjerrum (Abstr., 1907, ii, 551) and Denham (Trans., 1908, **93**, 41); it is possible that for other concentrations this relation is reversed. Alcohol and formaldehyde lower the extent of hydrolysis of aluminium and chromic sulphates, whilst sucrose is without influence.

T. H. P.

Passivity of Iron. Wolf J. Müller and Johannes Königsberger (*Zeitsch. Elektrochem.*, 1909, **15**, 742—746).—The authors reply to Krassa's criticism of their observations of the reflecting power of active and passive iron (this vol., ii, 738). They consider that they have proved definitely that iron may be passive when there is no film of oxide on it. Krassa's argument in favour of the oxide theory may be expressed thus: in many cases in which iron is passive, a skin of oxide can be seen on it; the skin will therefore exist in cases in which it is not visible. This is an inadmissible extrapolation of optical observations (compare also Manchot, this vol., ii, 1003). T. E.

Metallographic Observations in a Vacuum at High Temperatures. P. OBERHOFFER (*Metallurgie*, 1909, 6, 554—567).—A modification of Le Chatelier's microscope is described, by means of which a metal surface may be examined at temperatures from 0° to 1000° in a vacuum. The vacuum furnace is made of quartz, heated by a platinum resistance wound on quartz.

The formation of temper carbon when a steel containing 2·5% C and 1·7% Si is annealed has been observed in this apparatus, and it is shown that the formation of temper carbon takes place in the cementite and proceeds with increasing rapidity. C. H. D.

The Equilibrium Diagram of Iron-Carbon Alloys. FRIEDRICH WÜST [with N. GUTOWSKY] (*Metallurgie*, 1909, 6, 512—529).—The solidus curve of the iron-carbon series between 0 and 4·2% C has been determined by quenching experiments. The saturation point of the solid solution lies near 1·8% C. Carbon separates from the solutions only in the form of cementite, Fe_3C, the production of graphite being always due to a secondary decomposition of the cementite. The presence of silicon is not necessary for the liberation of graphite. The evidence on these points is provided by photo-micrographs of the alloys under various conditions of quenching. C. H. D.

Iron Phosphides. HENRI LE CHATELIER and S. WOLOGDINE (*Compt. rend.*, 1909, 149, 709—714).—Although nine different phosphides of iron have been described, the authors have been unable to prepare five of these. Four compounds, Fe_3P, Fe_2P, FeP, and Fe_2P_3, certainly exist, although the composition of the last two is not absolutely established.

Fused mixtures of phosphorus and iron containing more than 84·4% of iron were found to consist of crystals of Fe_3P embedded in a eutectic mixture of this phosphide with iron. The mass was powdered, and the more magnetic particles, separated by the magnet, had the composition Fe_3P. This phosphide may also be prepared by fusing copper phosphide with a sufficient quantity of iron, when almost pure Fe_3P rises to the top as a separate phase. This is also purified by removing non-magnetic impurities.

The *phosphide*, Fe_3P, has D 6·74, m. p. 1110°, and magnetic transformation point 445—435°. At the ordinary temperature its permeability is one-third that of pure iron. It dissolves in concentrated hydrochloric acid with production of pure hydrogen:

$$Fe_3P + 6HCl + 4H_2O \longrightarrow 3FeCl_2 + PO_4H_3 + 11H.$$

The next member of the series, Fe_2P, is insoluble in acids, except *aqua regia*. Mixtures of Fe_3P and Fe_2P form no eutectic, and the compound Fe_5P_2, described by Boblique, does not exist.

The *phosphide*, Fe_2P, is obtained by fusing excess of copper phosphide with iron. On dissolving the mass in nitric acid, beautiful crystalline needles, apparently hexagonal, remain. Reduction of phosphates by the aluminothermic method sometimes gives pure Fe_2P, which may also be obtained by fusing phosphorus with iron and separating the more magnetic impurities. Fe_2P has D 6·56, m. p. 1290°, magnetic transformation point 80°, and permeability about 1/50th that of Fe_3P.

The *phosphide*, FeP, is obtained by passing phosphorus vapour over Fe_2P at red heat until no further increase in weight occurs. It is slightly more magnetic than Fe_2P, D 5·76; magnetic transformation point 48°.

The *compound*, Fe_2P_3, has been prepared by the authors by the action of phosphorus iodide vapour on reduced iron. A variable mass is obtained, but on the edges steel-grey crystals of a non-magnetic character are found, which have a constant composition. It has D 4·5, and its magnetic permeability, 1/75th that of the phosphide FeP, is only thirty times that of distilled water. The permeability increases slowly as the temperature falls to $-50°$, but no magnetic transformation point could be found. R. J. C.

Reactions in Non-aqueous Solutions. IV. In Methyl Acetate.

Alexander Naumann [with Jean Rill and Ferdinand Bezold] (*Ber.*, 1909, **42**, 3789—3796. Compare Abstr., 1904, ii, 819).—The anhydrous methyl acetate used distilled between 56·8° and 57·6°, and had $D_4^{18} = 0·935$. For the majority of the experiments, half-saturated solutions were used. A lengthy list is given of salts which are soluble or insoluble in methyl acetate.

A solution of potassium thiocyanate reacts with solutions of sodium iodide and lithium nitrate, giving precipitates of potassium iodide and potassium nitrate respectively. Ammonium thiocyanate and lithium nitrate give a precipitate of ammonium nitrate.

At 18° the saturated solution of cobalt chloride in methyl acetate, $D_4^{18} = 0·938$, contains 1 part of solute to 271 parts of solvent. With potassium thiocyanate a white precipitate of potassium chloride is formed; with lithium nitrate the precipitation of lithium chloride is incomplete. On passing ammonia into the saturated solution, dark rose-red crystals, having the composition $CoCl_2,6NH_3$, were obtained.

Cobalt bromide dissolves in methyl acetate to the extent of 1 part in 9·74 at 18°; $D_4^{18} = 1·013$. With potassium thiocyanate the solution gives a precipitate of potassium bromide. On treatment with ammonia, pale rose-red crystals, $CoBr_2,6NH_3$, were obtained; these crystals lose ammonia on heating, and at 120° they have the composition $CoBr_2,2NH_3$, their colour then being blue. Hydrogen sulphide produces only a slight cloudiness in the solution of cobalt bromide; the further addition of ammonia gives a precipitate of cobalt sulphide.

At 18° a saturated solution of cupric chloride, $D_4^{18} = 0·939$, contains 1 part of that salt to 181 parts of methyl acetate. With stannous chloride a precipitate of cuprous chloride is produced. Ammonia produces a blue precipitate of the composition $CuCl_2,6NH_3$; at 135° these crystals lose ammonia and become green, their formula then being $CuCl_2,2NH_3$. With hydrogen sulphide a precipitate of cupric sulphide is formed.

A saturated solution of mercuric chloride, $D_4^{18} = 1·251$, contains

1 part mercuric chloride to 2·35 parts methyl acetate at 18°. With potassium thiocyanate, ammonium thiocyanate, barium iodide, and potassium mercuri-iodide, it gives precipitates of potassium chloride, ammonium chloride, barium chloride, and potassium chloride respectively. Ammonia gives the compound $HgCl_2,2NH_3$. With hydrogen sulphide a yellow compound, $HgCl_2,2HgS$, is produced, whereas with ammonia and hydrogen sulphide, mercuric sulphide is formed. Stannous chloride gives mercurous chloride when present in small amount, but when in excess mercury is precipitated.

Mercuric bromide dissolves in methyl acetate to the extent of 1 part in 4·56 at 18°. The solution has $D_4^{18} = 1·090$. Ammonia gives the compound $HgBr_2,2NH_3$, and hydrogen sulphide the yellow compound $HgBr_2,2HgS$. Ammonia and hydrogen sulphide together give rise to mercuric sulphide.

Calcium nitrate dissolves in methyl acetate to the extent of 1 part in 1·44 at 18°; $D_4^{18} = 1·313$. Hydrogen chloride produces a precipitate of the double compound, $CaCl_2,CH_3·CO_2Me$. This compound was also obtained when methyl acetate was dried with calcium chloride. Mercuric, stannous, zinc, cupric, and cobalt chlorides have no action.

T. S. P.

Phosphorus Compounds of Cobalt. S. F. SCHEMTSCHUSCHNY and J. SCHEPELEFF (*Zeitsch. anorg. Chem.*, 1909, **64**, 245—257)—Phosphides of metals of high melting point are conveniently prepared by making pellets of the metal with red phosphorus, heating in a crucible, then covering with barium chloride, and raising the temperature to the melting point. More metal is then added, and red phosphorus, enclosed in an asbestos tube, is introduced. A saturated alloy is obtained in this way, which may be re-melted with more metal. Alloys melting near 1500° must be melted in a magnesia crucible without protecting layer, barium chloride being volatile. A granulated carbon resistance furnace is used.

Cobalt phosphide, Co_2P, melts at 1386°, causing a maximum on the freezing-point curve. The eutectic point is at 1022° and 19·85 atomic % P. The compound undergoes a polymorphic change at 920°. Its hardness is 6, D 6·3—6·6, and the magnetic properties are much weaker than those of alloys containing free cobalt.

Microscopically, the phosphide forms sharply-defined crystals, whilst cobalt forms rounded crystal skeletons. C. H. D.

Preparation of Anhydrous Nitrates of Manganese, Copper, Nickel, and Cobalt. ANTOINE GUNTZ and MARTIN (*Bull. Soc. chim.*, 1909, [iv], **5**, 1004—1011. Compare Ditte, Abstr., 1880, 154). —The anhydrous nitrates are prepared by the action of nitric anhydride, or a solution of this in nitric acid, on hydrated salts of the metals. The reactions are carried out in a special apparatus figured in the original.

Manganese nitrate monohydrate is obtained by melting the hexahydrate in its water of crystallisation, and evaporating with the continuous addition of nitric acid drop by drop. The cooled mass on solution in nitric acid deposits pale pink, deliquescent crystals of the monohydrate. On warming, the latter melts, begins to decompose at 140°, and is completely decomposed at 190—200°. When fused with nitric anhydride, it yields the *anhydrous* salt; the latter occurs in colourless crystals with a faint pink tint, has heat of solution 12·93 cal., and is completely decomposed at 200°.

Anhydrous copper nitrate is a white powder, with a faint blue tinge, has heat of solution 10·47 cal., is very deliquescent, and begins to decompose at 155—160°.

Anhydrous nickel nitrate is a pale greenish-yellow powder, has heat of solution 11·82 cal., and begins to evolve nitrous fumes at 105—110°.

Anhydrous cobalt nitrate is a slightly pink powder, has heat of solution 11·88 cal., and begins to decompose at 100—105°.

T. A. H.

Reduction of Cr_2O_7'' by Thiosulphate. G. Povarnin and Chitrin (*J. Russ. Phys. Chem. Soc.*, 1909, 41, 1033—1042).—The authors have investigated the course of the reaction between potassium dichromate, sodium thiosulphate, and hydrochloric acid in varying proportions and concentrations at 17—18° (compare Luther and Rutter, Abstr., 1907, ii, 555; Jabłczyński, Abstr., 1908, ii, 935).

In concentrated solutions, the oxidation of the thiosulphate ion by dichromate proceeds most readily in absence of excess of acid, that is, when the solution contains not more than $8H^{\cdot}$ per 2Cr; when such excess of acid is present, increase of the concentration is accompanied by an increase in the proportion of thiosulphate ions decomposed. In no case did more than 4·2 mols. of sodium thiosulphate per 1 mol. $K_2Cr_2O_7$ take part in the first stage of the reaction.

The proportion of sulphur separated increases with the concentration of the hydrogen ions; in neutral solutions no sulphur is formed, the reaction proceeding according to the equation: $2Cr_2O_7'' + S_2O_3'' = CrO_4'' + 2SO_3'' + 3CrO_2$.

When the proportion of hydrogen ions is increased from 8 to 14 (per 2Cr), there occurs a small change in the amount of thiosulphate used up, but an increase in the quantity of sulphur separated; these results indicate that when the concentration of hydrogen ions is low, the reaction of formation of S_4O_6'' takes place, decomposition of S_4O_6'' occurring when the concentration of hydrogen ions is high.

T. H. P.

Anodic Behaviour of Tungsten. Max Le Blanc and Horace G. Byers (*Zeitsch. physikal. Chem.*, 1909, 69, 19—25).—As anode a commercial specimen of tungsten, containing 98—99% of the pure metal, and in some experiments a pure fused specimen were used; the cathode was usually of platinum, and a number of electrolytes were employed in the course of the experiments. The anode was weighed before and after an experiment, and from the loss in weight and the results of simultaneous measurements with a copper coulometer the valency with which tungsten dissolves could be calculated. Further, on the assumption that tungsten dissolves as a sexavalent metal, the efficiency of the current in dissolving tungsten could be determined.

When sulphuric, hydrochloric, and nitric acids in normal solutions are used as electrolytes, tungsten is practically unattacked. In solutions of phosphoric acid and of sodium hydrogen phosphate at high temperatures, it dissolves in the sexavalent form ; at low temperatures, however, the current efficiency is smaller. In oxalic acid with small currents and at high temperatures, the current efficiency reaches the theoretical value, but is much less with relatively large currents at room temperature. The current efficiency also approximates to the theoretical value in normal solutions of potassium hydroxide and of ammonium sulphide.

The change from the active to the passive (relatively insoluble) form of the metal is favoured by increasing the current density and by lowering the temperature. It is improbable that the passivity is conditioned by the formation of a layer on the surface of the metal ; it is more likely connected with a change in the reaction velocity. G. S.

Physico-chemical Researches on Tin. VIII. Ernst Cohen (*Zeitsch. physikal. Chem.*, 1909, 68, 214—231. Compare Abstr., 1908, ii, 858).—The change in the structure of tin, described by Hasslinger (Abstr., 1908, ii, 953) as a new form of "tin plague," has been further investigated. It is shown that the change in question is exhibited by all forms of tin which have been subjected to mechanical treatment (rolled tin, tin-plate, tin-foil). It takes place both above and below the temperature at which tetragonal tin is transformed into the rhombic form (161°), and is induced by simple contact with material which has already undergone the change in structure. With rise of temperature, the velocity with which the change takes place increases rapidly.

The observations indicate that the structural change of the worked metal consists in a recrystallisation process, the result of which is the formation of larger tin crystals from smaller ones. On the basis of this view, it follows that the various forms of mechanically worked tin are in a metastable condition with reference to unstrained tetragonal tin above 18°, and also with reference to grey tin below 18°. The so-called "Moiré metallique," which results when tin-plate is etched by means of hydrochloric acid and potassium chlorate, corresponds with the "recrystallised" tin. It is shown that this can be used to start the change in other samples of tin-plate. H. M. D.

Ammonia-Additive Products of the Iodides of Tin. Fritz Ephraim and Theodor Schmidt (*Ber.*, 1909, 42, 3856—3857).—If ammonia is led into a solution of tin tetraiodide in carbon disulphide, and at the same time the solvent is allowed to evaporate, a white substance having the composition $SnI_4,8NH_3$ is left ; it is insoluble in water, and gives stannic acid with nitric acid. It can also be produced by passing ammonia over tin tetraiodide, a solvent being unnecessary.

Stannous iodide on treatment with dry ammonia gives a yellow compound having the composition $SnI_2,2NH_3$. T. S. P.

Equilibrium Diagrams of Tin with Sulphur, Selenium, and Tellurium. Wilhelm Biltz and Werner Mecklenburg (*Zeitsch. anorg. Chem.*, 1909, 64, 226—235. Compare Pélabon, Abstr., 1906, ii, 454).—Mixtures of tin and sulphur can only be investigated as far as 23·4% S, further quantities of sulphur being lost by volatilisation. The compound SnS melts at 881°, and the eutectic mixture consists of almost pure tin. The passage of the molten sulphide into a viscous condition towards 950°, again becoming liquid at 1100°, was observed in a few instances, and has been recorded by other observers, but the conditions for a repetition of the experiment have not been found.

Sulphur and selenium form a compound, SnSe, melting at 861°, and another, either Sn_2Se_3 or $SnSe_2$, which melts near 650°, only the first being marked by a maximum on the freezing-point curve. The two eutectics consist of almost pure tin and selenium respectively.

The tin–tellurium mixtures are more readily investigated, owing to the lesser volatility of tellerium. There is a well-marked maximum at 800°, corresponding with the compound SnTe, the eutectics being tin and a mixture containing 85% Te and melting at 404° respectively.

[With W. Goldbeck.]—The microscopical investigation of the mixtures shows that the compounds SnS, SnSe, and SnTe crystallise well, but leaves the existence of a second selenide uncertain.

C. H. D.

Preparation of Vanadium and other Metals by the Thermite Method. Wilhelm Prandtl and Benno Bleyer (*Zeitsch. anorg. Chem.*, 1909, 64, 217—224).—Former attempts to reduce vanadium oxide by means of aluminium have either failed (see Koppel and Kaufmann, Abstr., 1905, ii, 593) or have yielded an impure metal (Vogel and Tammann, Abstr., 1908, ii, 502). A product containing 91—93% V has been obtained by reduction with a mixture of metals of the cerium group (Muthmann, Abstr., 1904, ii, 410; 1907, ii, 781).

Calcium reduces vanadium oxide vigorously, but owing to the absence of a fusible slag, the metal remains in isolated particles. A mixture of calcium (3 atoms) and aluminium (2 atoms) acts readily, and yields a fusible, crystalline slag and a homogeneous regulus. If large quantities are used, it is advisable to moderate the violence of the reaction by dilution with slag or previously prepared metal.

Vanadium, prepared in this manner, is a hard, steel-grey metal, taking a high polish. It is hard enough to scratch quartz. The content of vanadium does not exceed 94·5%, owing to the introduction of carbon, silicon, and iron from the calcium and aluminium. Crucibles of magnesia, or with a lining of magnesia, are required, or temporary crucibles which resist the temperature well may be made by ramming fluorite or magnesia into a tinned iron vessel round a cylindrical core.

C. H. D.

The Preparation of Vanadium by the Aluminothermic Method. Rudolf Vogel and Gustav Tammann (*Zeitsch. anorg. Chem.*, 1909, 64, 225. Compare preceding abstract).—Vanadium, containing 99·07% of the metal, may be obtained by reducing vanadium pentoxide with aluminium in a crucible lined with magnesia. Nearly 1% of silicon is present, but the product is free from aluminium. Occasionally, under undetermined conditions, a product containing much oxide is obtained. C. H. D.

Compounds of Antimony Pentachloride with Antimony Pentafluoride. A Contribution to the Theory of Valency. OTTO RUFF [with J. ZEDNER, KNOCH, and GRAF] (*Ber.*, 1909, 42, 4021—4044).—An investigation of the freezing-point curves of mixtures of antimony pentafluoride and antimony pentachloride shows the following compounds to exist: $3SbF_5,SbCl_5$; $2SbF_5,SbCl_5$; $SbF_5,SbCl_5$; $2SbF_5,3SbCl_5$; $SbF_5,2SbCl_5$, and $SbF_5,3SbCl_5$. The compounds $SbF_5,SbCl_5$, $2SbF_5,3SbCl_5$, and $SbF_5,3SbCl_5$ were isolated from the fusions and analysed; the compound $2SbF_5,SbCl_5$ was obtained in the pure form by extracting with liquid chlorine the solid obtained from fusions containing 60—66·7 mol. % SbF_5. The compound $SbF_5,2SbCl_5$ has a distinctly different crystalline form from those of its immediate neighbours. No indications were obtained of a compound $3SbF_5,2SbCl_5$. On fusion, all the compounds are to a very great extent split up into their components. Their behaviour on volatilisation depends on the external pressure. In a very good vacuum the only compounds which are primarily deposited from the vapour are $SbF_5,3SbCl_5$ and $3SbF_5,SbCl_5$.

Molecular weight determinations in sulphuryl chloride solution showed that $2SbF_5,SbCl_5$ behaves normally in 10% solution; in diluter solutions it is dissociated. $2SbF_5,3SbCl_5$ and $SbF_5,3SbCl_5$ give values which are only about one-third of the theoretical molecular weight, even in concentrated solution.

The following densities, D_0^{20}, were obtained: $2SbF_5,SbCl_5$, 3·08; $2SbF_5,3SbCl_5$, 2·79; $SbF_5,2SbCl_5$, 2·82, and $SbF_5,3SbCl_5$, 2·73. The respective molecular volumes are 236, 473, 287, and 406. When the compounds are formed from their constituents there is a considerable decrease in volume.

The chemical behaviour of these compounds, except in so far as their behaviour towards bromine and a mixture of arsenic trifluoride and bromine is concerned, is similar to what one would expect from a mixture of antimony pentachloride and antimony pentafluoride in the given proportions. When bromine is mixed with twice its weight of $3SbF_5,SbCl_5$ or $2SbF_5,SbCl_5$, there is a slight development of heat, and some of the compound dissolves in the bromine; on mixing with $2SbF_5,3SbCl_5$, $SbF_5,2SbCl_5$, or $SbF_5,3SbCl_5$, however, there is a considerable absorption of heat, and the mixture becomes liquid. The mixture of arsenic trifluoride and bromine does not give arsenic pentafluoride with any of the above compounds.

The isolation and properties of the individual compounds are described in detail.

As regards the affinity of the valencies which are used to form these compounds, the negative affinity of the antimony pentafluoride molecule is considered to lie between those of elementary fluorine and chlorine, whereas the affinity of the antimony pentachloride molecule is more negative than that of the iodine molecule, and about as strong as that of the bromine molecule. In the light of Werner's theory, the maximum co-ordination number of the antimony pentahalogenides is 8. T. S. P.

The Decomposition of Platinous Hydroxide into Platinum Dioxide and Metal. LOTHAR WÖHLER and FRIEDRICH MARTIN (*Zeitsch. Elektrochem.*, 1909, **15**, 791—792).—When platinous chloride or platinous hydroxide is dissolved in hydrochloric acid a little platinum and hydrochloroplatinic acid are always formed. Platinous hydroxide may be heated at 160° with water without decomposition; hydrochloroplatinous acid is also stable in hydrochloric acid solution at 120°. If, however, a nearly neutral solution of hydrochloroplatinous acid (obtained by reducing a solution of platinichloride with sulphur dioxide), or a solution of platinous chloride, is heated at 120°, quantitative decomposition into metal and a salt of quadrivalent platinum takes place. T. E.

Tervalent Platinum. LOTHAR WÖHLER and FRIEDRICH MARTIN (*Ber.*, 1909, **42**, 3958—3965. Compare Blondel, Abstr., 1905, ii, 720).—*Platinum trichloride*, $PtCl_3$, may be prepared by heating platinic chloride in pure, dry chlorine at 390°. After ten hours, the mass is completely converted into the trichloride, a dark green, nearly black, powder, dissolving slightly in cold water only after several days. It dissolves in boiling water to a reddish-brown acid solution. Hot concentrated hydrochloric acid decomposes it, forming the dichloride and tetrachloride. Like the dichloride, it dissolves readily in potassium iodide solution.

Hydrated *platinum sesquioxide*, Pt_2O_3,xH_2O, is prepared by adding the solid trichloride to a hot solution of sodium carbonate, or by dissolving in potassium hydroxide solution (1 : 1) and precipitating with acetic acid. The latter method yields a product containing some of the higher oxide. It is not possible to prepare it by the oxidation of moist platinous hydroxide by heating in air (compare this vol., ii, 322).

The colour of the hydrated oxide is brown, the shade being darker if precipitated hot. It is not oxidised by boiling with water through which a current of oxygen is passed. When dehydrated in a vacuum, decomposition takes place, and the oxide Pt_2O_3 has not been isolated. The hydroxide dissolves in concentrated alkali hydroxides, and in concentrated sulphuric acid. In its chemical behaviour it occupies an intermediate position between platinous and platinic hydroxides.

C. H. D.

Tervalent Platinum. II. LOTHAR WÖHLER and FRIEDRICH MARTIN (*Ber.*, 1909, **42**, 4100—4108. Compare preceding abstracts).—When potassium platinosochloride is oxidised with chlorine water at 0°, only the platinichloride is obtained, and the rubidium salt gives a similar result; but a cold solution of caesium platinosochloride gives with chlorine water a green, crystalline precipitate of *caesium platinosesquichloride*, Cs_2PtCl_5. This salt forms regular crystals, and may also be obtained by dissolving platinum trihydroxide in hydrochloric acid containing caesium chloride. For analysis, on account of the volatility of cæsium chloride, the salt is heated with oxalic acid in hydrogen, the temperature of decomposition being thus lowered. An impure product is obtained by adding cæsium chloride to platinum trichloride. Sunlight accelerates the decomposition into the higher and lower chlorides.

The free acid, H_2PtCl_5, has not been isolated, but on passing a little chlorine into a solution of the acid H_2PtCl_4, the presence of tervalent platinum may be recognised by precipitation as the green cæsium salt, but decomposition sets in rapidly.

The stability of tervalent platinum in simple and complex compounds is compared with that of similar derivatives of other metals.

C. H. D.

Iridium. Alexander Gutbier and M. Riess (*Ber.*, 1909, 42, 3905—3912).—Freshly precipitated iridium hydroxide dissolves in hydrobromic acid to a deep blue solution, which decomposes when warmed or evaporated, liberating bromine. It has not been found possible to isolate the compounds $IrBr_4$ or H_2IrBr_6, but the presence of the latter in the blue solution is proved by the action of alkali bromides, which precipitate the iridibromides. The same salts are obtained on adding alkali bromide to a solution of iridium chloride on the water-bath.

The iridibromides may be recrystallised from hot dilute hydrobromic acid containing a little bromine. They form small, bluish-black crystals, yielding a dark blue powder and blue solutions. They are more soluble than the corresponding chloro-compounds. They readily lose bromine in solution or when warmed.

Ammonium iridibromide, $(NH_4)_2IrBr_6$, and the *potassium*, *rubidium*, and *caesium* salts of the same composition, form dark blue octahedra. The sodium salt has not been obtained in a sufficiently pure state for analysis.

By the addition of a cold saturated solution of an alkali bromide to an excess of iridium chloride containing hydrochloric acid, the iridichlorides are precipitated as brownish-red crystals, identical with those prepared by other methods (compare following abstract). C. H. D.

Hexachloro-Iridium Compounds. Alexander Gutbier [with F. Lindner] (*Zeitsch. physikal. Chem.*, 1909, 69, 304—314. Compare Rimbach and Korten, Abstr., 1907, ii, 276).—Iridium tetrachloride, $IrCl_4$, has been prepared pure by Vauquelin's method, depending on the decomposition of ammonium iridium chloride, $(NH_4)_2IrCl_6$, by gaseous chlorine. From the tetrachloride the double salts with alkali chlorides of the type M_2IrCl_6 have been prepared by mixing hot aqueous solutions of the components; they have already been described by previous observers.

The remaining double salts described in the paper were prepared by mixing hot solutions of iridium chloride and the other chloride, and were recrystallised from hot dilute hydrochloric acid. *Methylammonium iridichloride*, $(NH_3Me)_2IrCl_6$, occurs in dark reddish-brown, lustrous, hexagonal plates; the corresponding *dimethylamine* compound, $(NH_2Me_2)_2IrCl_6$, in small, reddish-brown needles, and the *trimethylamine* compound, $(NHMe_3)_2IrCl_6$, in red, rhombic plates. *Ethylammonium* *iridichloride*, $(NH_3Et)_2IrCl_6$, occurs in dark reddish-brown, hexagonal crystals; the corresponding *diethylamine* compound, $(NH_2Et_2)_2IrCl_6$, in red, highly refracting plates, and the *triethylamine* compound, $(NHEt_3)_2IrCl_6$, in reddish-brown leaflets. *Propylammonium iridichloride*, $(NH_3Pr)_2IrCl_6$, occurs in very dark-coloured, highly refracting needles; the *dipropylamine* compound, $(NH_2Pr_2)_2IrCl_6$, in brown, monoclinic, highly refractive crystals, and the iso*propylamine* compound, $(NH_3Pr^{\beta})_2IrCl_6$, in red, highly refracting needles. *Butylammonium iridichloride*, $(NH_3C_4H_9)_2IrCl_6$, occurs in brownish-red, highly refracting plates; the iso*butylamine* compound in reddish-brown leaflets.

Ethylenediammonium iridichloride, $(C_2H_{10}N_2)IrCl_6$, forms black, highly refracting, rhombic plates; the *propylene* compound,

$$(C_3H_2N_2)IrCl_6,$$

also forms almost black plates. *Pyridinium iridichloride*,

$$(C_5NH_6)_2IrCl_6,$$

and the corresponding α-picoline compound, $(C_5NH_5Me)_2IrCl_6$, form large, red needles; the quinoline compound, $(C_9NH_8)IrCl_6$, in small, red, monoclinic needles. *Benzylammonium iridichloride*,

$$(NH_3 \cdot C_7H_7)_2IrCl_6,$$

the *dibenzylamine* compound, $[NH_2(C_7H_7)_2]IrCl_6$, and the *benzylethylamine* compound, $(NH_2Et \cdot C_7H_7)_2IrCl_6$, all form reddish-brown, rhombic needles. G. S.

Mineralogical Chemistry.

Spectrographic Analysis of Blende. GEORGES URBAIN (*Compt. rend.*, 1909, **149**, 602—603).—The arc spectra of sixty-four samples of blendes have been examined between wave-lengths 2663·3 and 3403·8 in the ultraviolet with the special object of finding new minerals containing germanium. Thirty-eight blendes contained germanium, which was present in appreciable amounts in the five samples emanating from Webb City (Missouri), Stolberg (near Aix-la-Chapelle), European Turkey, Raibl (Corinth), and Mexico respectively.

Nearly all the blendes contained gallium, silver, copper, cadmium, and lead, whereas indium was present chiefly in those which contained little or no germanium. Samples from Zinnwald, Wirtzborn, and Scharfenberg were particularly rich in indium. Tin was found in thirty-two specimens, antimony in twenty-six, cobalt in fourteen, bismuth in ten, arsenic in nine, molybdenum in five. Iron and manganese were also very frequent.

These results indicate only the relative rarity of the elements in question, since by chemical concentration nearly all can be detected in every blende. R. J. C.

Arizonite: Ferric Metatitanate. CHASE PALMER (*Amer. J. Sci.*, 1909, [iv], **28**, 353—356).—The new mineral occurs as irregular masses together with gadolinite, which it somewhat resembles in external appearance, in a pegmatite-vein near Hackberry, in Arizona. Its fracture is subconchoidal, with a dark steel grey colour and metallic to sub-metallic lustre; the streak is brown. The mineral is opaque, but under the microscope very thin splinters are deep red by transmitted light. One indistinctly developed crystal was found; this is described doubtfully as monoclinic. The mineral is brittle; H 5—6, D 4·25. Analysis I agrees closely with the formula $Fe_2O_3,3TiO_2$, that is, ferric metatitanate. The mineral is thus distinct from ilmenite, which is essentially ferrous titanate, FeO,TiO_2; iserine is possibly a mixture of the two.

	TiO_2.	FeO.	Fe_2O_3.	H_2O.	Total.*
I.	58·26	0·70	38·38	1·20†	100·12

* Including portion insoluble in hot concentrated sulphuric acid, consisting of TiO_2, 0·56; SiO_2, 1·02.

† Of this amount, 0·18 per cent. is expelled below 110°.

The gadolinite gave the partial results under II:

	SiO_2.	Y_2O_3, &c.	Ce_2O_3, &c.	GlO.	FeO.	Total.	Sp. gr.
II.	24·41	36·86	11·50	11·50	11·56	95·83	4·28

L. J. S.

Errors in the Determination of Water in Zeolites. Stanislaus J. Thugutt (*Centr. Min.*, 1909, 677—686).—The amount of water held by zeolites is a function of the size of the particles of the material (that is, dependent on the surface energy), the tension of aqueous vapour in the surrounding atmosphere, and the period of time that the material remains in contact with this atmosphere. Zeolites in a finely-powdered condition (the particles measuring 1—10μ across) gave on ignition more water than when the material was more coarsely powdered (grains 0·1—0·5 mm. diameter); in the twenty-four minerals so examined, there were differences of from 0·41% to 4·88% between the two determinations for each mineral. Apophyllite, on the other hand, loses some of its water on being finely powdered. More detailed experiments were made with natrolite from Leitmeritz, Bohemia, and with apophyllite from Guanajuato, Mexico. The natrolite consisted of perfectly clear, prismatic crystals of some size, and they appeared to be perfectly pure, but microchemical coloration tests proved the presence of traces of diaspore, hydrargillite, calcite, and chalybite. Analysis gave the results under I, agreeing closely, after deducting the slight amount of impurities, with the formula $Na_2Al_2Si_3O_{10},2H_2O$. The water determination (9·77% loss on ignition, including 0·20% CO_2 present as calcium, iron, and magnesium carbonates) was made with the coarsely-powdered material (0·1—0·5 mm.); the same sample when finely powdered (1—3μ) lost on ignition 12·31%. Colourless crystals of apophyllite when coarsely powdered gave analysis II, corresponding with the formula

$$4(CaSi_2O_5,2H_2O),KF.$$

The same sample of material when finely powdered contained 15·87% H_2O (the amount required by the above formula is 15·84%).

	SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	F.	H_2O.	Total, less O for F.	Sp. gr.
I.	47·34	26·84	0·11	0·11	0·04	0·14	15·96	—	9·77	100·31	2·26
II.	53·01	—	—	23·76	0·48	3·62	0·37	1·91	16·78	99·13	2·352

L. J. S.

Stellerite, a New Zeolite. Józef A. Morozewicz (*Bull. Acad. Sci. Cracow*, 1909, 344—359).—A new zeolite, stellerite, has been found at the N. W. Cape of Copper Island, one of the Komandorski islands in the Aleutian Group of Islands.

Analysis gave the following composition :

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Na_2O.	H_2O.
59·23	14·41	0·22	8·23	—	18·15

It is a calcium aluminoheptasilicate, $CaAl_2Si_7O_{18},7H_2O$, and crystallises in the rhombic system, $a : b : c = 0·98 : 1 : 0·761$; $D = 2·124$, and the hardness is $3\frac{1}{2}$—4. On treatment with hot $2N$-hydrochloric acid, crystalline, doubly refracting skeleton-crystals of silica are left, possessing a definite optical orientation.

The behaviour of the zeolites towards hydrochloric acid depends on the number of atoms of silicon to the molecule. Only when there are more than 5 such atoms of silicon is a doubly refracting skeleton-crystal of silica left.

The general formula of the zeolites should be written

$$MAl_2Si_nO_{2n+4} + mH_2O.$$

T. S. P.

Chemical Investigation of Mosandrite and Wöhlerite, occurring together, and of Certain Minerals of the Matrix. G. P. Tschernik (*Bull. Acad. Sci. St. Pétersbourg*, 1909, 903—925).—The author has examined the various constituents of a Norwegian ore (probably from the shores of the Langesund fjord), the principal one consisting of pale grey plates of felspar, D^{17} 2·626, having the composition :

SiO_2.	Al_2O_3.	K_2O.	Na_2O.	Fe_2O_3.	CaO.	MgO.	TiO_2	FeO.
66·02	18·79	6·94	6·85	0·14	0·26	0·06	Trace	Trace

F.	CO_2.	Loss at red heat.	Total.
Trace	Trace	0·42	99·48

These figures correspond well with the formula

$$30SiO_2,5Al_2O_3,2K_2O,3Na_2O$$

or $2K_2Al_2Si_8O_{16}.3Na_2Al_2Si_6O_{16}$.

Next to the felspar, the most abundant constituent is one which occurs in large pieces varying in colour from greenish-blue to reddish-brown, and exhibiting traces of crystalline faces. The greenish-blue form, D^{17} 2·606, hardness 5, has the composition :

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	F.	Total.
44·11	32·27	0·96	0·29	0·08	3·95	17·01	0·84	Trace	99·81

this mineral is hence a variety of elaeolite of the formula,

$$4Na_8Al_8Si_8O_{12}.K_2Al_2Si_4O_{12}.$$

One of the reddish-brown specimens (I), D^{17} 2·509, and another darker one (II), D^{17} 2·494, give on analysis the following results :

	SiO_2.	Al_2O_3.	Na_2O.	K_2O.	CaO.	MgO.	Fe_2O_3.	H_2O.	F.	Total.
I.	42·98	31·99	14·30	2·91	0·25	0·05	0·78	5·79	Trace	99·12
II	41·39	31·87	12·73	1·95	0·22	0·05	0·74	10·36	Trace	99·31

These figures do not correspond in either case with any simple formula, and the three varieties, greenish-blue, reddish-brown, and dark reddish-brown, certainly represent one and the same mineral in different stages of efflorescence; the molecules of water present in the three cases are in the proportion 1·0129 : 7·217 : 13·399.

The next mineral examined consisted of thin, pale yellow plates with a brown tinge, D^{16} 2·986, hardness 4—5, having the composition:

SiO_2.	TiO_2.	ZrO_2.	ThO_2.	Ce_2O_3.	Y_2O_3.	CeO_2.	CaO.	FeO_2.	MnO.	MgO.
37·19	5·13	3·82	0·70	20·80	0·79	5·58	12·75	2·22	0·22	1·32

Na_2O.	K_2O.	Al_2O_3.	Fe_2O_3.	H_2O.	F.	Total (less $O = 2F$).
1·92	0·21	3·25	0·25	2·32	2·45	99·89

These figures correspond with the formula:

$$19SiO_2,2TiO_2,(ZrO_2,ThO_2),2(Ce_2O_3,Y_2O_3),CeO_2,7CaO,(FeO,MnO),MgO,(K_2O,Na_2O),(Al_2O_3,Fe_2O_3),4F,4H_2O.$$

The mineral is allied to those of the mosandrite group.

A specimen of woehlerite occurring in the same ore in large, yellow prisms, D 3·45, hardness greater than 5, was found to have the composition:

SiO_2.	Ce_2O_3.	ZrO_2.	Cb_2O_5.	CaO.	FeO.	MnO.	MgO.	Al_2O_3 and Fe_2O_3.
30·11	Trace	18·25	12·80	26·78	0·70	0·57	0·16	Traces

Na_2O.	F.	H_2O.	Total (less $O = 2F$).
7·67	2·80	0·26	98·92

This compositon is expressed approximately by the formula

$$10SiO_2,3ZrO_2,Cb_2O_5,10CaO,2·5Na_2O,3F$$

or $Zr_3Cb_2Ca_{10}Na_5F_3Si_{10}O_{42}$. T. H. P.

Physiological Chemistry.

The Influence of Training on the Output of Carbon Dioxide in Isometric Muscular Work. A. F. HELLSTEN (*Skand. Archiv. Physiol.*, 1909, 22, 1—22).—The experiments were carried out by a form of ergograph (Johansson's) in which the contractions are isometric, and their net results show that with training the output of carbon dioxide is diminished for the same amount of work. The amount of the decrease varies in individuals. W. D. H.

"Accessory Breathing" in Animal Tissues. FR. BATTELLI and LINA STERN (*Biochem. Zeitsch.*, 1909, 21, 487—509).—The experiments on animals recorded lead to the conclusion that the respiratory process consists of two, probably distinct, parts, main respiration and accessory respiration; the former falls off, and then vanishes after death; the latter continues (especially in the liver) constant for a long time after death. Phein, a hypothetical substance previously described by the authors, which can be extracted with water from several tissues (muscle, liver, etc.), does not influence accessory breathing. The respiratory quotient in this form of breathing is very low. The influence of various factors is described at length, and among these temperature may be mentioned, the optimum being 50—55°.

W. D. H.

Passage of Calcium Ions through the Blood-corpuscles. Hartog J. Hamburger (*Zeitsch. physikal. Chem.*, 1909, **69**, 663—685). —The view generally held that blood-corpuscles do not contain calcium is erroneous. When defibrinated ox-blood is subjected to centrifugal action to remove the serum, and the corpuscles, after washing several times with a solution of sucrose to remove every trace of calcium and chlorine, are placed in dilute sodium chloride solution, calcium can be detected in the solution after a time.

When a little calcium chloride is added to blood, it is found after a time that only part of it is present in the serum, showing that the corpuscles are permeable for $Ca^{\cdot\cdot}$ ions. When serum mixed with sodium chloride or water is added to blood, calcium passes from the serum into the corpuscles. The increased proportion of calcium which has entered the corpuscles can be washed out by treating the latter with normal serum, so that $Ca^{\cdot\cdot}$ ions can pass in either direction through the walls of the corpuscles.

As regards the conditions for the transference of $Ca^{\cdot\cdot}$ ions inside the cells, this appears to occur only when an exchange is possible with equivalent or non-equivalent ions on the other side. Differences of osmotic pressure are very important in this connexion. G. S.

Modifications in the Chemico-physical Properties of Blood-serum by Heating at 55—60°. G. Quagliariello (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 217—222).—In blood-serum, which has been heated at 55—60° and then submitted to dialysis, the globulins are precipitated more slowly than in the original serum, the retardation increasing with the duration of heating. The heated and dialysed blood-serum behaves towards the ordinary reagents like strongly alkaline proteins. The electrical conductivity of the serum, even after heating at 55—60° for several days, does not differ appreciably from that of normal serum, but the vicosity is augmented by an amount increasing with the duration of heating. When the heating is continued for not less than twelve days, the serum gradually gelatinises at the ordinary temperature (22—23°). The velocity of thermal coagulation of the heated serum is notably inferior to that of normal serum.

These observations are explained as due to the transformation of the proteins of the serum, by the prolonged action of gentle heating, into alkali proteins (meta-proteins); part of the carbon dioxide is expelled by the heating, so that the alkalinity increases, the alkalis normally existent in the serum being sufficient to effect the transformation mentioned above. T. H. P.

Estimation of Antipepsin in Serum. Y. Oguro (*Biochem. Zeitsch.*, 1909, **22**, 266—277).—Horse's serum is more antipeptic than the serum of rabbit and man. In disease in man, very little variation was found, but this aspect of the subject is to be continued. The peptic activity is determined by the carmine-fibrin method, also by the time taken to dissolve gelatin, or render a solution of ricin clear. W. D. H.

An Anti-Substance to Globin. Carl H. Browning and G. Haswell Wilson (*J. Path. Bact.*, 1909, 14, 174—183).—A full account of a research previously published (this vol, ii., 817). W. D. H.

The Influence of Pepsin and the Amount of Hydrochloric Acid on the Intensity of Digestion, Especially in the Absence of Free Hydrochloric Acid. Julius Schütz (*Biochem. Zeitsch.*, 1909, 22, 33—44).—Casein and egg-white undergo marked peptic digestion when the hydrochloric acid is deficient; the presence of hydrogen ions is not necessary, but digestion begins when a very small amount of hydrochloric acid united to the protein is present. The digestive activity on egg-white increases as more acid is added, and within certain limits this increase is proportional to the square root of the amount of acid. The square root rule also holds for peptic action in the absence of "free" acid. W. D. H.

The Relationship between the Proteolytic Power, the Nitrogen, and the Total Solids of the Pancreatic Juice. B. P. Babkin and N. P. Tichomiroff (*Zeitsch. physiol. Chem.*, 1909, 62, 468—491).—A parallelism exists between the proteolytic activity of pancreatic juice (dog) as measured by Mett's method and the nitrogenous constituents, especially protein, of the juice. If the protein percentage is taken as the measure of the amount of trypsin present, the results of digestive activity come out very closely according to the Schütz-Borissow law of square roots. W. D. H.

Chemistry of Digestion and Absorption in the Animal Body. XXXIV. Further Methods. E. S. London. **XXXV. Digestion and Absorption in the Stomach of the Dog.** E. S. London and W. W. Polowzowa. **XXXVI. The Behaviour of Nucleo-protein in the Alimentary Canal.** E. S. London. **XXXVII. The Intestinal Digestion of Proteins.** E. S. London and F. Rivosch-Sandberg. **XXXVIII. The Relation between Digestion Time and Absorption.** E. S. London and W. W. Polowzowa (*Zeitsch. physiol. Chem.*, 1909, 62, 443—445, 446—450, 451—454, 455—461, 462—464).—XXXIV. These methods deal with details of operative procedure.

XXXV. If gliadin is administered to dogs, the glutamic acid is not absorbed in the stomach, but is present in the unabsorbed material, not free, but in combination with other constituents of the protein molecule.

XXXVI. In the stomach about two-thirds of the nucleo-protein given passes into solution, and the dissolved substance gives the reactions of nucleic acid. In the duodenum an excess of nitrogen and phosphorus are present, which originate from the juice secreted there. The cleavage of the nucleo-protein molecule occurs in the intestine, due to the action of the succus entericus.

XXXVII. The "formaldehyde method" can be applied with good results for the determination of the amount of amino-acids in the intestinal contents. The proteoses and peptones which leave the stomach undergo further cleavage in the intestine, and this is the main duty of the pancreatic juice.

XXXVIII. A parallelism is shown to exist between the time occupied and the amount of digestion and absorption which take place. W. D. H.

Does Absorption depend on the Surface Tension of the Absorbed Fluid? Giuseppe Buglia (*Biochem. Zeitsch.*, 1909, 22, 1—23).—From experiments *in vitro* and *in vivo* (with intestinal loops), in which the surface tension of solutions of salts and Witte's peptone was reduced by bile and other substances, the conclusion is reached that such procedure does not favour absorption, and therefore that Traube's views on the importance of surface tension are incorrect.

W. D. H.

Action of Lead Hydrosol and Lead Acetate on Metabolism. Luigi Preti (*Biochem. Zeitsch.*, 1909, 21, 551—561).—The administration of lead hydrosol and acetate to dogs in non-toxic quantities furthers nitrogenous catabolism, leading to a deficit of nitrogen in the body. This persists for days subsequently. The urea is much increased; the effect on uric acid is not so decided. W. D. H.

The Biological Action of Salts. II. Influence of Salts on Metabolism. Ernst Schloss (*Biochem. Zeitsch.*, 1909, 22, 283—289. Compare this vol., ii, 598).—The salts employed lead to retention of water in the body; sodium chloride acts in this way more strongly than the bromide, and that more strongly than the iodide; the chlorides of potassium and calcium are also the most powerful salts in this direction. Large doses, except in the case of sodium chloride, lead later to loss of water and of body weight. It is believed that the action of salts has a simple chemico-physical explanation, which is postponed until the next paper on the subject. W. D. H.

Influence of Carbohydrates and Fats on Protein Metabolism. E. Provan Cathcart (*J. Physiol.*, 1909, 39, 311—330).—From experiments on man, it was found that the urinary nitrogen falls on a pure carbohydrate diet, but it rises markedly on a pure fat diet. During inanition, the urine always contains creatine, but its amount is lessened on taking carbohydrate alone, and is increased by taking fat alone. The amount excreted during the fat period is not markedly reduced by adding protein to the food. The hypothesis is put forward that carbohydrates are absolutely essential for endocellular synthetic processes in connexion with protein metabolism, and it is probable that food stuffs should be valued, as Chauveau suggested, more on account of their isoglycogenic than their isodynamic value. W. D. H.

The Value of Protein-cleavage Products in the Human Organism. EMIL ABDERHALDEN, FRANZ FRANK, and ALFRED SCHITTENHELM (*Zeitsch. physiol. Chem.*, 1909, 63, 215—221. Compare this vol., ii, 817).—An experiment was carried out on a boy (with stricture of the œsophagus, and who was fed by rectum) similar to those previously conducted on animals. For fifteen days he was fed on the abiuretic products of meat which had been subjected to lengthy pancreatic digestion. Full details are given, the net result of which was that the boy remained in nitrogenous equilibrium and even put on flesh, whilst his general condition improved. W. D. H.

Nuclein Synthesis in the Animal Body. ELMER V. McCOLLUM (*Amer. J. Physiol.*, 1909, 25, 120—141).—Without palatability a ration may possess all the necessary food ingredients and yet fail to properly nourish an animal. This factor has in the past been much neglected in attempts to study the action of pure food principles. Very young animals, however, adapt themselves to a low degree of palatability more readily than adults. All the phosphorus needed for skeleton, nuclein, and phosphatide formation can be drawn from inorganic phosphates. An animal has the power to synthesise the purine bases necessary for nuclein formation from complexes contained in protein molecules, and does not necessarily use purine bases of exogenous origin for the purpose. W. D. H.

Disappearance of Pentosans from the Digestive Tract of the Cow. ELMER V. McCOLLUM and W. A. BRANNON (*J. Amer. Chem. Soc.*, 1909, 31, 1252—1260).—This investigation was carried out with the object of comparing the relative ease with which the pentosans from different sources disappear from the digestive tract, and to ascertain the behaviour of methylpentosans under the same conditions. Cows were fed exclusively on plants of a single kind, either maize, wheat, or oats, and in each case the excreta were collected and the pentosans estimated. The results show that the pentosans of the maize plant are more easily attacked and disappear from the digestive tract to a greater extent than those of the wheat and oat plants, and that the methylpentosans of these three plants are less resistant to the agencies operating in the digestive tract than the simple pentosans. In order to study the action of the intestinal bacteria on the pentosans, fermentation experiments were carried out with maize fodder, wheat straw, and oat straw respectively, and it was found that the pentosans of the maize plant are less resistant than those of the oat plant, and that the latter are less resistant than those of the wheat plant, these results being in accord with those observed in the feeding experiments. E. G.

Rôle of Inorganic Phosphorus in the Nutrition of Animals. EDWIN B. HART, ELMER V. McCOLLUM, and J. G. FULLER (*Univ. Wisconsin Agric. Exper. Stat. Research Bul.*, 1909, 1).—Pigs fed on a ration very deficient in phosphorus gained in weight as much as when receiving abundance of phosphorus up to a certain point (70 to 100 lbs.), after which there was a loss of weight, followed by collapse.

When calcium phosphates were added to rations otherwise deficient in phosphorus, development was normal, and the results equal to those obtained with phosphorus wholly in organic forms.

Determinations of calcium and phosphorus in the principal organs and tissues of pigs fed with low amounts of phosphorus showed results similar to those obtained with normally fed pigs. In the bones, however, the percentage of ash was reduced to about one-half.

A growing pig (50 lbs.) should receive 4—5 grams of phosphorus per day. N. H. J. M.

Enzymes of the Placenta. Walther Löb and Shigeji Higuchi. **Ash Constituents of the Placenta.** Shigeji Higuchi (*Biochem. Zeitsch.*, 1909, 22, 316—336, 341—344. Compare this vol., ii, 76).—The blood-free placenta, whether fresh or dried, contains catalase, oxydase, and a diastase which acts on starch and glycogen. Inulase, lactase, invertase, glycolytic and lipolytic enzymes are present in fresh, but not in dry, placenta. The same is true for a pepsin-like enzyme, but enzymes of the type of erepsin, urease, and de-amidases are absent.

The various mineral constituents were estimated and the results given in a table. Sodium salts are the most abundant. Calcium salts show great variations. By washing out the blood, the yield of iron is lessened from 0·07 to 0·014%. W. D. H.

Purines and Purine Metabolism of the Human Fœtus and Placenta. H. Gideon Wells and Harry J. Cooper (*J. Biol. Chem.*, 1909, 6, 469—482. Compare this vol., ii, 749).—Guanase appears at the third month of fœtal life, and adenase at the fifth month. The liver at the fifth month contains both enzymes, thus differing from the pig and dog's livers. Xantho-oxydase is demonstrable in the liver and combined viscera at full term, but not in muscle, intestines, kidney, spleen, or thymus. It appears at or after the sixth month. It is an enzyme which is easily destroyed. The uricolytic enzyme is absent throughout. Fœtal tissues contain more guanine than adenine, for, after autolysis, twice as much xanthine as hypoxanthine is found. The presence of xantho-oxydase or uricase could not be demonstrated in mature placenta. The placenta contains 14% of nitrogen (dry weight), and about 2·1% of this is purine nitrogen; of this, 45% is guanine, 40% is adenine, and 15% hypoxanthine. Xanthine occurs in traces only. W. D. H.

Trypsinogen and Enterokinase in the New-born Child and in the Human Embryo. Jussuf Ibrahim (*Biochem. Zeitsch.*, 1909, 22, 24—32).—The various proteolytic enzymes of the human alimentary canal are present at birth. They appear almost simultaneously during fœtal life; pepsin appears at the beginning of the fourth month, trypsin during the same month, enterokinase at the same time or a little later, and erepsin in the fifth month.

W. D. H.

Chemical Composition of the Dog's Body. J. Stockhausen (*Biochem. Zeitsch.*, 1909, 22, 244—265).—Statistical tables of the weight, percentage of nitrogen, and other details of the tissues and organs of four dogs. Two of these were fed on protein-poor and two on protein-rich diet; in the latter, the nitrogen of liver and muscles was increased. W. D. H.

The Physiology of the Glands. XIV. The Influence of Proteins and Protein Degradation Products on the Activity of the Liver. LEON ASHER and DIMITRI PLETNEW (*Biochem. Zeitsch.*, 1909, 21, 355—380).—The method of investigation consisted in adding to dogs' diets sugar in quantities just insufficient to produce alimentary glycosuria, and then superimposing on these diets proteins, or peptones, or amino-acids. These additions caused glycosuria, and as sugar output is regulated by the liver, the conclusion was drawn from the results that this organ takes part in the metabolism of protein and protein degradation products, the addition of such products taxing the capacity of the liver beyond its physiological limits. This conclusion is also fortified by the fact that bile pigments also appear in the urine. The sugar output lasts until the day after the administration of the extra protein or protein degradation products. S. B. S.

The Part Played by the Liver in Creatinine Metabolism. E. S. LONDON and N. BOLJARSKI (*Zeitsch. physiol. Chem.*, 1906, 62, 465—467).—From experiments on two dogs, in which the liver was thrown out of gear by an Eck's fistula, the following conclusions are drawn. The amount of creatine excreted is greatest on days when no food is given. The admixture of creatinine with the food does not increase the amount found in the urine; admixture of the food with creatine caused no increase in the excretion of that substance, but raised the output of creatinine. Sodium nucleate produces no marked result. W. D. H.

Autolysis. T. KIKKOJI. **Autolysis and Preservatives.** ERNST SALKOWSKI (*Zeitsch. physiol. Chem.*, 1909, 63, 109—135, 136—142).—The first paper relates to the action of chloroform water, toluene, and mixtures of these reagents in varying proportions, also to the action of formaldehyde and benzoic acid on the course of autolysis. The optimum concentration of each is determined, but autolysis runs a quicker course when the optimum concentration of some preservatives is used than it does for others, for instance, it is more rapid for benzoic acid in comparison with chloroform. The second paper is mainly critical, and emphasises the point that the antiseptic selected is not immaterial, and neglect to recognise this will explain divergent results hitherto published. W. D. H.

The Non-dependence of Autolytic Protein-cleavage on the Presence of Blood. ERNST BLOCH (*Biochem. Zeitsch.*, 1909, 21, 519—522).—The autolytic enzymes which produce protein-cleavage in the dog's liver are really tissue-enzymes, and bring about autolysis when the organ is entirely freed from blood. W. D. H.

The Hæmolytically Acting Organ Extracts. Julius Morgenroth and P. Schäfer (*Biochem. Zeitsch.*, 1909, 21, 305—320).—The extracts of organs which act hæmolytically owe this property, not to substances in solution, but to substances in suspension. Experiments were carried out with alcoholic extracts of pancreas (made by extracting the organ with alcohol diluted with physiological saline) to determine the conditions under which the most active preparations could be obtained. It was found that the extracts made from organs of well-fed animals were more active if the organs had been previously allowed to autolyse for some hours at room temperature. The extracts from fresh organs of fasting animals were more active than those from well-fed animals; there was not the corresponding increase in activity in this case after autolysis. It was also shown that the matter causing hæmolysis can be taken up by suspended matter, as experiments made with particles of coagulated serum proteins with sodium oleate solutions showed. The particles of protein which had taken up the oleate were capable of acting hæmolytically. S. B. S.

Action of Extracts of the Pituitary Body. Henry H. Dale (*Bio-Chem. J.*, 1909, 4, 427—447).—Extracts of the posterior lobe of the pituitary directly stimulate all kinds of involuntary muscle without any relation to innervation. The action is nearly allied to that of digitalis, but the pituitary substance acts less powerfully on the heart, and more powerfully on plain muscle, than the members of the digitalis group. The active principle is excreted in the urine. Repeated injections produce no true immunity in the sense that immune substances are developed. The evidence adduced by Schäfer and Herring, that the extract contains separate pressor and diuretic substances, is considered inadequate. W. D. H.

Chemico-physical Investigations on the Crystalline Lens. G. Quagliariello (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 288—294. Compare Bottazzi and Scalinci, this vol., ii, 502).—The author has studied the velocity of coagulation of the crystalline lens at 65° in 0·9% sodium chloride solution, with and without the addition of various proportions of sodium hydroxide.

With 0·9% sodium chloride solution at 65°, the ratio of the surface of the lens in sq. cm. to the time occupied in coagulation in minutes has the constant value 0·0186, so that the true measure of the velocity of coagulation of a solid is given by the area of the surface which coagulates in unit time.

In presence of sodium hydroxide, the velocity of coagulation diminishes with, but not proportionally to, the concentration of the alkali. The curve connecting the velocity with concentration of sodium hydroxide resembles a logarithmic curve, and is apparently asymptotic to the concentration axis. The imbibition of the lens in alkali or acid solution is not augmented or diminished by decrease or increase of the osmotic pressure of the solution in which the lens is immersed. T. H. P.

Diastases. III. The Behaviour of the Diastase in the Blood. Julius Wohlgemuth (*Biochem. Zeitsch.*, 1909, 21, 381—422).—The diastatic power was estimated by the author's method, by determining the smallest quantity of the ferment which is capable of degrading 5 c.c. of a 1% starch solution to dextrin in a given time (twenty-four hours), using iodine solution to determine this factor. It was found that the starch degradation products under these conditions caused no inhibition of the ferment action. The diastatic power of serum is the same as that of plasma. Treatment of the serum with fibrin does not diminish its diastatic capacity. The diastatic capacity remains unchanged on keeping the serum (under aseptic conditions) for several months. The diastatic concentration of serum from all the superficial blood-vessels is the same. The smallest amounts of diastase are found in human blood, ox, and goat; somewhat more is found in the blood of rabbits, and the largest quantities in the blood of guinea-pigs and dogs. The blood of a fasting dog contains as much ferment as that of a well-fed animal. The quality of the diet has no influence on the amount; neither have specific excitants of the pancreas, such as secretin and hydrochloric acid. The ligaturing of the pancreatic ducts increases the amount largely. The increase commences after three to four hours, reaches its maximum in twenty-four hours, at which it remains for several days (generally six to eight), after which the quantity gradually returns to the normal. The increase also occurs when the animal is kept without food after the operation. Increase also occurs even after ligature of a single duct. It occurs, too, after partial extirpation of the pancreas. Adrenaline-glycosuria, phloridzin, and phloretin diabetes have no influence on the quantity of diastase. Asphyxia does not increase the amount. The pancreas is not the sole source of the diastase of the blood. S. B. S.

Diastases. IV. The Question of the Internal Secretion of the Pancreas. R. Ehrmann and Julius Wohlgemuth (*Biochem. Zeitsch.*, 1909, 21, 423—431).—The quantity of diastase from the blood taken from the vena pancreatico-duodenalis was compared with that of the blood taken from a femoral artery. In only one case (several experiments were carried out under different conditions of nutrition) could an increased quantity from the former vein be detected, and this was only very slight. Care was taken that none of the blood came into contact with any of the gland substance. S. B. S.

Diastases. V. The Behaviour of the Diastase of the Urine. Julius Wohlgemuth (*Biochem. Zeitsch.*, 1909, 21, 432—446).—The acidity or alkalinity of the natural urine is without marked effect on the diastatic action. The urine of males contains more diastase than that of females. In fasting condition, the urine contains the most diastase; the quantity sinks after ingestion of food, and reaches a minimum in three to four hours, afterwards it rises again. Similar results were obtained with rabbits' urine. The amount of diastase in dogs' urine is small. In cases of nephritis and diabetes, the amount was smaller than the normal. In dogs with ligatured pancreatic ducts, the amount of diastase ran parallel with that found in the blood (see preceding abstract). A high diastase-concentration was also found at times in the urine of human patients with obstructed pancreatic duct. In dogs with obstructed bile ducts, an increase in the diastase in the urine was only observed after several days. This increase is probably due to a disturbance in the pancreatic duct as a result of the operation, and not a direct consequence of the ligature of the bile duct. If the latter is ligatured in animals in which the pancreatic duct had been previously obstructed, no increase of diastase in the urine was observed. S. B. S.

Diastases. VI. The Influence of the Bile on Diastases. Julius Wohlgemuth (*Biochem. Zeitsch.*, 1909, 21, 447—459).—Bile alone has little diastatic power. It has, however, the power of increasing the diastatic action of other plant and animal diastases (diastases of saliva, serum, pancreas, etc.). The activating action is probably due, not to a ferment, but to a heat-stable, dialysable substance which is soluble in alcohol. S. B. S.

Diastases. VII. The Diastase Content of Different Organs of the Rabbit under Normal and Pathological Conditions. A Contribution to the Subject of the Nature of Phloridzin Diabetes. Julius Wohlgemuth and J. Benzur (*Biochem. Zeitsch.*, 1909, 21, 460—475).—The kidneys contain the largest amount of diastase; the muscles contain less, and the liver less still. Phloridzin increases the amount of diastase in the kidneys, and, in two out of four cases, the amount in the liver. It had no effect on the diastase-content of the blood. The action of phloretin was similar. No increase in the amount of liver diastase was observed after administration of adrenaline. The authors discuss the bearing of their results on the question of phloridzin diabetes. S. B. S.

Diastases. VIII. The Influence of Radium Emanations on the Action of the Diastatic Ferment. S. Loewenthal and Julius Wohlgemuth (*Biochem. Zeitsch.*, 1909, 21, 476—483).—Radium emanations favour the action of the diastatic ferment of the blood, liver, saliva, and pancreas. The action is not immediate, for in the first twenty-four hours an inhibition is observed. This passes off, and finally there is an increased action. In certain cases, however, only the inhibitory action was observed. S. B. S.

Oxidation Products of Cholesterol in the Animal Organism. IV. Isaac Lifschütz (*Zeitsch. physiol. Chem.*, 1909, 63, 222—234. Compare this vol., ii, 77).—The oxycholesterols of the blood-fat, which are almost completely absent in the liver cells, are believed to be transformed by the liver into acid compounds in the bile. Although found in certain organs, they are not only absent from the liver, but also in the bile and fæces of the animals investigated (ox and horse). The paper contains a discussion of the probable rôle of cholesterol in the body, and among the functions attributed to it is that of assisting emulsification in the upper part of the intestine. W. D. H.

The Biological Significance of Lecithin. III. The Lecithin and Iron Content of Human Milk and Cow's Milk. W. Glikin (*Biochem. Zeitsch.*, 1909, 21, 348—354).—When the fats are separated from milk, practically all the lecithin (as determined by phosphorus estimations in the whole milk and the cream) goes into the cream. The total lecithin iron was also determined, and it was found that the higher the lecithin content of a given sample, the higher was the iron content. S. B. S.

Pentoses in the Urine of Men and Animals. Utilisation of Pentoses in the Animal Organism. LUIGI COMINOTTI (*Biochem. Zeitsch.*, 1909, 22, 106—119).—Herbivora and pigs on an abundant diet excrete pentoses in their urine, but only in small quantities as compared with the pentosans in the food. The greater part of the pentosans is therefore utilised in the body. Pentose is absent from the urine of dogs on bread and meat diet, and of men on a meat diet, but human urine always contains pentose if the diet is a mixed one. In the fasting horse, pentose disappears from the urine, but on prolonged inanition it reappears in small quantities; this is probably due to the catabolism of certain organs which yield pentose. W. D. H.

The Question of the Existence of Glycine in Normal Human Urine. G. OEHLER (*Biochem. Zeitsch.*, 1909, 21, 484—486).—The glycine was isolated in the form of the β-naphthalenesulphonyl chloride derivative. The urines of twelve healthy workers of the Pathological Institute of Berlin were examined. In eleven cases the quantity of the derivative isolated was too small to determine gravimetrically, and in a twelfth case 0·054 gram was obtained. S. B. S.

The Aromatic Compounds in Urine. W. MOOSER (*Zeitsch. physiol. Chem.*, 1909, 63, 155—200).—In estimating phenol and *p*-cresol in urine by Kossler and Penny's method (Abstr., 1893, ii, 100), several difficulties have been met with. The method of distillation with sulphuric acid in order to hydrolyse phenylsulphuric acids and subsequent titration gives low results for *p*-cresol. This can be overcome by using phosphoric acid in place of the sulphuric. It is also shown that when phenols are distilled with calcium carbonate and water, evolution of carbon dioxide occurs, and a portion of the phenol remains in the distillation flask as a calcium phenoxide. This is overcome by passing a stream of carbon dioxide through the flask during the distillation. The following is the general method for estimating phenols in urine recommended. A weighed quantity (250—500 grams) of the urine is made faintly alkaline, and evaporated to one-fifth of its volume on the water-bath. It is transferred to a distillation flask fitted with a condenser and receiver. Syrupy phosphoric acid is run in (about one-fifth of the original volume of urine), and the whole well shaken and distilled to about 100 c.c.; 50. c.c. of water are added, and the distillation continued. These operations are repeated until a drop of the distillate no longer gives the Millon test. An excess of calcium carbonate is added to the distillate in a capacious flask, and the distillation repeated whilst a stream of pure carbon dioxide is led through the apparatus. Water is added, and the distillation continued until all the phenol has passed over, when the distillate is titrated by Kossler and Penny's method.

The results obtained show that 1 litre of fresh cow's urine contains 0·5—0·77 gram of combined *p*-cresol during winter feeding and 0·25—0·46 gram during summer feeding. When the urine (winter feeding) is allowed to undergo decomposition, the amount of *p*-cresol increases, as a rule, to an appreciable extent (1·13 grams per litre), and a small part of this is in the free, but the greater proportion is still in the combined, state.

The average amount of combined *p*-cresol in human urine is 0·036—0·053 gram per diem.

In estimating benzoic acid in decomposed urine, the authors add sulphuric acid and extract with light petroleum (b. p. 40°) in a Katz apparatus, and titrate with standard alkali, using litmus as indicator. The results show some 8·5 grams of benzoic acid per litre of decomposed urine.

The results of an investigation as to the phenols present in cow's urine indicate that phenol itself is absent, and that the chief substance is *p*-cresol, with probably a small amount of the meta-compound.

Städeler's oil, *urogon* (*Annalen*, 1851, 77, 17), has been examined. It was separated from the alkaline solution of phenols by extraction with light petroleum. Its analyses agree fairly well with the formula C_7H_8O. It has b. p. 199·9° (corr.), as determined by Schliermacher's method, mol.-wt. 130, D^{15} 1·0201, and n^{21} 1·5289. It is insoluble in water, and is decomposed when warmed with alkalis; with dilute alkalis it gives a hydrocarbon, urogene, and when fused with potassium hydroxide yields a phenol (urogol). Dilute chromic acid has no action on the oil, and permanganate yields no definite products. The oil forms additive compounds with bromine and iodine.

Urogene, $C_{21}H_{42}$, crystallises in slender needles, has m. p. 59·9—60°, and b. p. 140°/high vacuum (green light). It does not combine with bromine even in sunlight. It is possible that rogene is identical with Willstätter's phytene (Abstr., 1907, i, 784).

Urogol, C_7H_8O, has b. p. 207·6° (corr.), n^{26} 1·53054, and gives the ordinary phenolic reactions. It yields an iodo-derivative of a grass-green colour.

J. J. S.

Chemistry of Cancer. S. Yoshimoto (*Biochem. Zeitsch.*, 1909, 22, 299—308).—During autolysis of the cancerous liver and still more of the cancerous breast, proteolysis is much more energetic than in normal tissues, and this depends not on the tumour itself, but on the portions of the organ which are still approximately normal. The partition of nitrogen in the autolysed fluid differs in liver cancer from that obtained from the normal organ in two points, namely, in a lessening of the purine nitrogen, and an increase in the nitrogen of diamino-acids, ammonia, and peptone.

W. D. H.

Chemical Composition of Milk from Tuberculous Cows. A. Monvoisin (*Compt. rend.*, 1909, 149, 644—645).—The author gives in tabular form the results of analyses of milk from cows in various stages of tuberculosis. The fats, lactose, and casein diminish with the progress of the malady, whilst the total nitrogen increases, owing to increased infiltration of proteins. The ash increases, especially the sodium chloride. The refractive index of the serum diminishes, whilst its electrical conductivity increases. In the more advanced stages of tuberculosis, the composition of the milk approximates to that of blood-serum. W. O. W.

The Physiological Effects of Selenium Compounds with Relation to their Action on Glycogen and Sugar Derivatives in the Tissues. Charles O. Jones (*Bio-Chem. J.*, 1909, 4, 405—419).—In the body, selenate is reduced to selenite; a small quantity is excreted in the urine, and the remainder is carried to the spleen and liver, where it is reduced by dextrose to selenium; when dextrose furnished from the glycogen is becoming exhausted, fat is called on. There is a retention of chlorides, a disappearance of hydrochloric acid, and a great relish for sodium chloride. This is interpreted as meaning that the salt raises the sugar in the blood to satisfy the selenite, and so protect the cells from toxic effects.

It is suggested that dextrose is possibly the means by which all reduction processes in the body are brought about. W. D. H.

The Action of Thorium on the Normal and on the Fatty-Degenerated Heart. S. Tuveri (*Arch. Farm. sperim.*, 1909, 8, 297—306).—The thorium salts act exactly in the same way as the cæsium salts on the excised frog's heart both when in normal condition and after fatty degeneration. S. B. S.

The Fate of Lactic Acid in Normal Animals, and in those Poisoned with Phorphorus. E. Neubauer (*Arch. exp. Path. Pharm.*, 1909, 61, 387—400).—If sodium lactate is given to normal rabbits, it is not completely burnt in the body, but it partly leaves the body in the urine as lactic acid, and in the form of other acids soluble in ether. In rabbits poisoned with phosphorus, exactly the same occurs. The administration of sugar or alanine does not increase the urinary acids which are soluble in ether, in either class of animals.

W. D. H.

The Behaviour of 3 : 5-Di-iodo-*l*-tyrosine and 3 : 5-Di-iodo-*r*-tyrosine in the Animal Organism. Adolf Oswald (*Zeitsch. physiol. Chem.*, 1909, 62, 399—403).—The two substances were administered to dogs and rabbits, and the excreta examined. From the urine, the major part of the iodine was recovered, and in the case of the *l*-compound, about 46% was present in ionised form; in the case of the *r*-compound, about 50%. The compounds, in which the remainder of the iodine occurred, are not yet fully identified.

W. D. H.

Physiological Behaviour of *l*- and *d*-Suprarenine. V. Emil Abderhalden, Karl Kautzsch, and Franz Müller (*Zeitsch. physiol. Chem.*, 1909, 62, 404—409. Compare this vol., ii, 751).—In dogs, the previous administration of *d*-suprarenine does not modify the effect produced on blood-pressure by the injection of *d*- and *l*-suprarenine.

W. D. H.

The Varying Activity of *apo*Morphine Preparations and the Pharmacological Behaviour of *apo*Morphine Derivatives (Euporphine, etc.). ERICH HARNACK and HERMANN HILDEBRANDT (*Arch. exp. Path. Pharm.*, 1909, 61, 343—362).—There are doubtless several *apo*morphines related closely to one another, but differing in their action on frogs; their paralysing action on the central nervous system and on striped muscles is about equal. The amorphous varieties show actions differing qualitatively on warm-blooded animals. Bergell and Pschorr's dibenzoyl*apo*morphine, in which the hydroxyl groups are no longer intact, is not an emetic. The euporphine (*apo*morphine methobromide) of the same authors is a very feeble emetic, although the hydroxyls are intact; it has a curare-like action. A combination of the ammonium base of euporphine with *apo*morphine raises the paralysing action on the frog. Commercial euporphine contains 8% of *apo*morphine, and acts as an emetic.

W. D. H.

The Behaviour of Synthetic Muscarine in the Animal Body. II. HERMANN FÜHNER [and, in part, E. ROSENOW] (*Arch. exp. Path. Pharm.*, 1909, 61, 283—296. Compare Abstr., 1908, ii, 1061).—The estimation of synthetic muscarine may be carried out biologically on the isolated frog's heart. Rabbits fed on muscarine pass it in their urine in small quantities, but if the drug is given subcutaneously, much more is present. The urine of rabbits on a mixed diet has a slight muscarine-like action. If muscarine is given in lethal doses, it can be detected in the blood, but not when it is given in non-lethal doses. Similar experiments were made on cats. W. D. H.

Action of Poisons on Tissue Respiration. HORACE M. VERNON (*J. Physiol.*, 1909, 39, 149—183).—Freshly excised rabbits' kidneys were perfused with saline solution containing the poison for half an hour, and then with oxygenated saline for ten hours. The oxygen absorbed and carbon dioxide produced were estimated. Various poisons were found to depress the respiratory activity in different degrees. A theory is propounded that the tissues can absorb oxygen by means of a substance present which forms an organic peroxide, and this by the help of a peroxydase can transfer the oxygen to amino-acids and carbohydrates in the tissues. Some poisons (hydrocyanic acid, sodium fluoride, etc.) paralyse respiration by uniting with aldehyde groupings, and others (formaldehyde, acids, and alkalis) paralyse the power of forming carbon dioxide by destroying the peroxydase.

W. D. H.

Poisoning with Inorganic and Organic Acids. ALEXANDER SZILI (*Pflüger's Archiv*, 1909, 130, 134—135).—By means of experiments on animals, it has been deduced that the toxic action of inorganic acids is dependent, as a rule, on their strength, that is, the amount of their dissociation; this, however, is not always the case, sulphuric acid being, for instance, much more lethal than nitric acid. In the case of organic acids, the dissociation constants bear no relation whatever to their toxicity; the physiological action is due not alone to the dissociated hydrogen ions, but also, and in a greater degree, to the undissociated parts of the molecule. W. D. H.

Toxicology of Tin with Special Reference to the Metallic Contamination of Canned Foods. SAMUEL B. SCHRYVER (*J. Hygiene*, 1909, 9, 253—263).—Quantities of tin approximating two grains to the pound are unusual and unnecessary, and any food stuff containing such quantities should be regarded with suspicion as likely to cause irritant poisoning. A summary is given of a large number of analyses of canned foods contaminated by metal, most of which had been in tins for years. Experiments showed that the ingestion of such foods was very unlikely to be followed by chronic tin poisoning. A method is described by means of which tin can be rapidly estimated colorimetrically. W. D. H.

The Abolition of Oxalic Acid Poisoning in the Frog, and the Cause of Oxalic Acid Action. HANS JANUSCHKE (*Arch. exp. Patt. Pharm.*, 1909, 61, 363—375).—The frog's heart, paralysed by oxalic acid, begins to beat again on the injection of calcium chloride. The toxic action of the acid on other organs is similarly antagonised by calcium salts and also by strontium salts. This does not depend on the removal of oxalic acid from the poisoned cells, but on the restoration of the constituents of the cells which are lost. Paralysis of the frog's heart by barium is antagonised by sodium sulphate.
W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Chemical and Biological Investigations on Slime-Producing Lactic Acid Bacteria. ROBERT BURRI and O. ALLEMANN (*Zeitsch. Nahr. Genussm*, 1909, 18, 449—461).—Experiments are described in which sterilised milk was inoculated with the ordinary and the slime-producing forms of Freudenreich's *Bact. Güntheri*, and Jensen's acid *Streptococcus*, *Bacillus casei*-ϵ, and *B. casei*-δ. The soluble nitrogen, the nitrogen not precipitated by phosphotungstic acid, the nitrogen as ammonia, the volatile acids, the total acidity, and the lactose were determined. The results indicate that the two forms of the lactic acid bacteria are identical as regards the chemical effects produced.

The slime produced by the bacteria resembles chitin in its composition and reactions. N. H. J. M.

The Formation and Consumption of Nitrous Oxide by Bacteria. MARTINUS W. BEYERINCK and D. C. J. MINKMAN (*Centr. Bakt. Par.*, 1909, ii, 25, 30—63).—Nitrates are reduced by certain soil organisms in presence of organic matter and absence of air to form nitrous oxide, nitrogen, and ammonia. Two organisms were observed by Gayon and Dupetit to bring about this change, and were designated α and β; they are now identified by the author as *Bacillus pyocyaneus* and *B. Stutzeri* (= *B. nitrogenes*) respectively. The author has also isolated and described two other powerful nitrate-reducers, *Bacillus nitroxus,* a polymorphic spore former, which is probably the chief nitrate destroyer in the soil, and *Micrococcus denitrificans.* So vigorous is the process that, under favourable conditions, a stream of gas can be obtained containing 80% of nitrous oxide, and rekindling a glowing splint; this happens, for instance, when soil is inoculated with bouillon containing 5 to 12% of nitrate, and the mixture kept at 20—37°. If less nitrate is present, the gases contain more free nitrogen and less nitrous oxide. The chief agent is *B. nitroxus.* Of the other organisms examined, *B. pyocyaneus,* grown in bouillon with 1% of nitrate at 37°, evolved a gas containing 65—72% of nitrous oxide; *B. Stutzeri* evolved gas containing 10%, and *Micrococcus denitrificans* evolved gas containing 20% of nitrous oxide and 42% of nitrogen.

There can be little doubt that nitrous oxide is produced in the soil, and also that it is destroyed in some way. Experiments showed that the denitrifying organisms, especially *B. Stutzeri,* could decompose it, forming nitrogen and carbon dioxide; it also acts as the oxygen source for a *Spirillum.*

The author has added one more instance to the remarkable list of "chemosyntheses," namely, syntheses of complex cell-substances from carbon dioxide by living organisms without the aid of chlorophyll or sunlight. The necessary energy was obtained by the organism simultaneously absorbing, or else determining the action between, hydrogen and nitrous oxide mixed in equal proportions. The organism is somewhat like *B. Saussurei,* which also synthesises its organic matter from carbonates, but derives the energy from the union of hydrogen and oxygen that it can in some way bring about.

The culture solution consists of tap-water, 100 parts, dipotassium phosphate, 0·02 part, ammonium chloride, 0·02 part, and sodium hydrogen carbonate, 0·01 part. No organic matter is supplied. After inoculation, the whole is placed in an atmosphere of nitrous oxide and hydrogen, which is slowly brought into reaction as the organism develops.

E. J. R.

Biochemistry of Micro-organisms. I. Quantitative Estimation of Nitrate Fermentation. Hartwig Franzen and E. Löhmann (*Zeitsch. physiol. Chem.*, 1909, 63, 52—102).—The amounts of nitrogen as nitrates and nitrites were estimated at intervals of twenty-four hours in broth cultures of different organisms containing 1·0119 gram of potassium nitrate (in 95 c.c.). The following numbers indicate (1) the amounts of nitrogen as nitrites, and (2) the loses as free (or ammoniacal) nitrogen, as percentages of the initial nitrogen.

The results show that *Bacillus Plymouthensis*, *B. prodigiosus*, *B. Kiliense*, *Proteus vulgaris*, *B. coli commune*, and *B. typhi murium* convert nitrates into nitrites without much further change; and that *B. pyocyaneus* not only reduces nitrates to nitrites, but at once

Days.		*Bacillus Plymouthensis.*	*B. prodigiosus.*	*B. Kiliense.*	*B. pyocyaneus.*	*Proteus vulgaris.*	*B. coli commune.*	*B. typhi murium.*
1	1.	25·59	42·39	29·59	1·73	32·04	32·18	21·83
	2.	8·80	2·04	4·02	5·13	3·40	3·72	14·98
2	1.	—	53·91	56·73	0·36	44·84	59·01	67·23
	2.	—	2·07	6·15	15·14	4·36	6·80	5·44
3	1.	56·24	54·44	58·51	0·33	47·19	67·83	92·07
	2.	8·20	1·63	5·18	22·31	4·81	5·12	6·15
4	1.	60·41	53·46	62·24	1·29	50·21	63·44	95·63
	2.	8·26	2·30	3·69	28·69	4·14	3·84	4·37
5	1.	69·38	53·35	—	1·42	52·39	63·16	94·90
	2.	7 91	2·54	—	32·41	3·83	3·97	5·19

converts the nitrites into non-oxidised nitrogen. *B. fluorescens liquefaciens* had no action on nitrates. N. H. J. M.

Enzymes which Produce Cleavage of Polysaccharides in the Expressed Juice of Fungi. Hans Pringsheim and Géza Zemplén. **Studies on the Amount of Oxydases in the Same.** Hans Pringsheim (*Zeitsch. physiol. Chem.*, 1909, **62**, 367—385, 386—389).—The juices expressed from thirteen varieties of fungus (*Aspergillus*, *Mucor*, etc.) were tested with five disaccharides and one trisaccharide (raffinose); considerable variations exist between the different fungi as to the kind of sugar they are able to decompose; these are stated in detail.

The opportunity was also taken to test the juices for catalase, oxydase, and peroxydase; and, again, the results obtained differ with the various fungi. W. D. H.

The Theory of Disinfection. I. The Disinfecting Action of Phenol. Heinrich Reichel (*Biochem. Zeitsch.*, 1909, **22**, 149—176, 177—199).—I. The partition of phenol between an oily and aqueous phase was investigated, and also the influence of the addition of sodium chloride on this distribution. The phenol was estimated in the water before and after the addition of the oil. From the numbers obtained, the author shows how the factor of distribution of the phenol between the two phases can be calculated when the contractions on mixture of phenol-water, phenol-oil, and other constants have been ascertained.

II. The coefficient of partition between phenol and the phases coagulated protein and water, both in presence and absence of varying quantities of sodium chloride, was investigated. The methods employed were similar to those described in the previous section. Coagulated egg-white and serum-albumen were employed and also *Bacterium pyocyanaeus*. S. B. S.

A Comparison of the Germicidal Power of a Disinfectant in Solution and in the Emulsified State. R. E. Massey (*J. Hygiene*, 1909, **9**, 341—346).—Martin and Chick's experiments (this vol., ii, 171) are considered invalid, because they failed to take into account the influence of alcohol in decreasing germicidal activity. The present experiments with "tricresol," however, confirm their conclusions regarding the superiority of a disinfectant in the emulsified state.

W. D. H.

Influence of Aluminium Salts on Protoplasm. M. Fluri (*Bied. Zentr.*, 1909, 38, 670—672; from *Flora*, 1908, 99, 81—126).—Cells of *Spirogyra* in presence of light are deprived of starch by dilute solutions of aluminium salts (0·003—0·01%); when the threads are afterwards placed in tap water, starch is again produced. Lanthanum and yttrium nitrates produce the same results as aluminium salts. The shortest time of the action of aluminium salts is two days with 0·01% solutions. No effect is produced in presence of dextrose, *iso*dulcitol, or glycerol.

The loss of starch may be due to increased diastatic activity under the influence of aluminium salts, but is more probably caused by increased permeability of the plasma. Assimilation is not interrupted during the removal of the starch.

N. H. J. M.

Are the Amines Assimilable by the Higher Plants? Marin Molliard (*Compt. rend.*, 1909, 149, 685—687).—Lutz (Abstr., 1898, ii, 530) has brought forward facts which appear to show that plants are capable of directly assimilating amines of low molecular weight, such as methylamine. The experiments described in the present communication do not support this view. Radishes have been grown under conditions precluding the intervention of micro-organisms. In one series of experiments the plants were supplied with a solution containing all the elements necessary for their nutriment, except nitrogen; in a second series, calcium nitrate was supplied in addition, whilst the nutrient solution in the other series contained ammonium chloride, or the hydrochlorides of methylamine, dimethylamine, ethylamine, and propylamine. Parallel experiments were carried out, employing solutions containing 5% of dextrose in addition. It appears from the tabular statement given, that in the latter cases the plants increased considerably in weight when treated with calcium nitrate or ammonium chloride. The amines, however, showed a distinctly inhibitory influence on their growth.

W. O. W.

Fermentative Ammonia Cleavage in Higher Plants. Wl. Butkewitsch (*Zeitsch. physiol. Chem.*, 1909, 63, 102).—A reply to Kiesel (this vol., ii, 694).

N. H. J. M.

Origin and Physiological Function of Pentosans in Plants. C. Ravenna and O. Cereser (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 177—183).—Experiments on dwarf beans yield the following results. No marked variation of the amount of pentosans is observed during the period of activity of the chlorophyll. During the night, however, the variations are considerable, and consist sometimes of increase and sometimes of diminution. When the carbohydrate food consists wholly of dextrose, administered to the leaves, the amount of pentosans increases greatly, especially in the light. When the function of the chlorophyll in the leaves is prevented for a somewhat prolonged period, the amount of pentosans diminishes. The conclusion is drawn that the simple sugars, more than the complex carbohydrates, exert a preponderating influence on the formation of pentosans, which function as a reserve material when the plant has exhausted the more readily utilisable foodstuffs. T. H. P.

The Physiological Significance of Certain Glucosides. Th. Weevers (*Proc. K. Akad. Wetensch. Amsterdam*, 1909, **12**, 193—201).—Quantitative experiments with *Salix purpurea* lead to the conclusion that catechol, after hydrolysis of salicin and transport to other parts of the dextrose thus formed, remains localised in the cell and again combines to form salicin with dextrose, which is brought from elsewhere or has been formed on the spot by assimilation. The relationship of arbutin and quinol in *Vaccinium vitis idaea* was investigated on similar lines. From young shoots of *Salix purpurea* were obtained a *salicase*, identical with neither emulsin nor amygdalase, a *saligenolase*, destroyed at 85°, forming catechol from salicyl alcohol, and a thermostable *catecholase*, which does not attack salicyl alcohol, but brings about very rapidly the oxidation of catechol to a black, insoluble substance.

Populus monilifera yields an enzyme, *populase*, which splits off benzoic acid from populin. This glucoside is not hydrolysed by the mixture of enzymes from *Salix purpurea*. G. S. W.

Distribution of Sugar, Acid, and Tannin in Apples. W. Kelhofer (*Bied. Zentr.*, 1909, **38**, 678—679; from *Landw. Jahrb. Schweiz*, 1908, 745—923).—Analysis of four varieties of apples showed that the highest percentage of sugar is in the flesh; that the acidity increases from the outside towards the centre, and the tannin from the centre outwards.

During ripening, the amount of acid decreased from 9·72 to 3·95%, whilst the tannin changed only slightly, increasing from 1·57 to 1·68%. The distribution of the three chief constituents is, on the whole, the same in unripe as in ripe apples. N. H. J. M.

Existence of a Glucoside in the Olive. Bartolo Lino Vanzetti (*Atti R. Accad. Lincei*, 1909, [v], **18**, ii, 188—190. Compare Körner and Vanzetti, Abstr., 1903, i, 430; Power and Tutin, Trans., 1908, 891, 904).—An alcoholic extract of young branches of the olive deposits, after a long time, mannitol and a micro-crystalline substance, which resembles a paraffin, but was not investigated. When the residual extract is dissolved in water, and the tannin, extractives, and colouring matters separated by dialysis, the dialysed liquid assumes a brilliant blue fluorescence, which recalls that exhibited by æsculin and other derivatives of hydroxycoumarin, and is rendered more evident by making the solution alkaline. The concentrated solution reduces Fehling's solution, and, when treated with excess of phenylhydrazine yields *d*-phenylglucosazone. T. H. P.

Physiological Function of Hydrogen Cyanide in Sorghum vulgare. Ciro Ravenna and M. Zamorani (*Atti R. Accad. Lincei*, 1909, [v], 18, ii, 283—287).—The amino-acids being, according to present-day views, regarded as the compounds from which proteins are directly synthesised in plants, the authors consider that the passage of the nitrogen from nitrates to proteins is represented by the scheme: nitrates ⟶ hydrogen cyanide ⟶ amino-compounds ⟶ proteins (compare Ravenna and Peli, Abstr., 1908, ii, 217). Support for this view is accorded by examination of plants of *Sorghum vulgare*, to some of which asparagine has been administered as nitrogenous food-material. It is found that these plants contain considerably less hydrogen cyanide than those to which no asparagine was supplied. The asparagine added is regarded as being utilised in the plants, which could hardly live and develop during the period of the experiments (thirty to thirty-five days) on their reserve of nitrates alone. T. H. P.

[Constituents] of Vebernum dentatum. Charles R. Blake (*Chem. News*, 1909, 100, 210).—The berries contain dextrose, lævulose, protein, tannin, malic acid, and two fixed oils, the one clear, the other dark green. The latter appeared to consist mainly of laurin. The ash of the berries contains, in addition to the usual constituents, manganese and chromium sesquioxides. T. A. H.

Rôle of Oxidation in Soil Fertility. Oswald Schreiner and Howard S. Reed (*U.S. Dept. Agric. Bureau of Soils, Bul.* 1909, 56).—Roots of growing plants have an extracellular oxidising power which is most energetic in the portions of the roots provided with root-hairs. Plants growing in extracts of productive soils show a greater oxidising power than those in extracts of unproductive soils.

Oxidation is usually promoted by treating the soil extracts with an absorbing agent, and is generally accelerated by addition of nitrates. Calcium salts and phosphates are beneficial, and chlorides and sulphates are also somewhat beneficial when combined with a suitable base, such as sodium. Ammonium sulphate is less beneficial than the same amount of nitrogen in the form of nitrate. Organic toxic substances are extremely injurious to oxidation; their action is diminished by the presence of nitrates.

The process of oxidation is largely, if not entirely, due to the activity of a peroxydase produced by the roots. The enzyme is most active in neutral or slightly alkaline solutions, whilst its action may be inhibited by the presence of acid, and by conditions in which putrefaction processes occur. N. H. J. M.

Phosphate Availability in Relation to Soil Activity. Charles W. Stoddart (*Univ. Wisconsin Agric. Exper. Stat. Research Bul.*, 1909, No. 2, 50—60).—Acid soils were found to be deficient in available phosphorus, the phosphoric acid being combined with iron and aluminium to a greater extent than in normal soils.

Extraction with *N*/5 nitric acid for five hours at 40° was found to be very suitable for determining available phosphoric acid, the calcium phosphate being dissolved and very little besides. The humus of acid and of non-acid soils was found to contain about the same amounts of phosphorus; the amount of humus generally decreases as the percentage of phosphorus in the humus increases. Indications were obtained that the phosphorus of humus may be unavailable to plants. N. H. J. M.

Behaviour of Cereals towards Calcium Cyanamide. Sante de Grazia (*Bied. Zentr.*, 1909, 38, 712—713; from *Staz. sper. agrar. ital.*, 1908, 41, 657).—Experiments with wheat grown in a clayey soil showed that calcium cyanamide may be used in large amounts when applied three weeks before sowing the seed. N. H. J. M.

Can Sodium Nitrate be Replaced by Calcium Nitrate for Sugar Beet? Julius Stoklasa (*Chem. Zentr.*, 1909, ii, 1489; from *Zeitsch. landw. Versuchswesen Oesterr.*, 1909, 12, 627—636).—Sodium nitrate gives higher yields of roots and of sugar than calcium nitrate. It is considered probable that sodium can partly take the place of potassium, although not in the synthesis or breaking down of carbohydrates. N. H. J. M.

Amount and Composition of the Drainage Waters Collected During the Year 1908-9. Bryce C. Burt (*Rep. Cawnpore Agric. Stat.*, for the year ending June 30th, 1909, 22—23. Compare this vol., ii, 261).—The total amounts of rain and drainage, and of nitrogen as nitrates in the drainage, from June 1st to October 31st were as follows:

No.	Depth of soil, inches.	Rainfall, inches.	Drainage, inches.	Nitrogen as nitrates. Per million.	Nitrogen as nitrates. Lbs. per acre.
1.	72	31·53	14·154	31·96	102·38
2.	72	31·53	13·952	33·67	106·29
3.	36	31·53	15·205	18·80	64·70
4.	36	31·53	15·725	16·08	57·23

As in previous years, the soil was kept free from vegetation and was frequently hoed. N. H. J. M.

Analytical Chemistry.

A Device for Preventing Over-Titrating. Ferdinand Schulz (*Chem. Zeit.*, 1909, 33, 1187).—In the liquid to be titrated is placed an open tube about 12—15 mm. in diameter, and the titration is carried out as usual whilst rotating the beaker. The column of liquid inside the tube has, however, not yet been acted on, so by using the tube as a stirrer, the two liquids mix and any over titration will be again neutralised. The last drops of the volumetric solution are then added very cautiously. L. de K

Porcelain Gooch Crucibles with a Layer of Spongy Platinum. Henri J. F. de Vries (*Chem. Weekblad*, 1909, 6, 816—818. Compare Abstr., 1907, ii, 504, 719; 1908, ii, 430, 534; Brunck, this vol., ii, 826).—A claim for priority. The crucible described by Brunck has been employed by the author for two and a-half years. The method of preparing the platinum layer is described. A. J. W.

Detection of Traces of Chlorides in Gelatin. Lüppo-Cramer (*Zeitsch. Chem. Ind. Kolloide*, 1909, 5, 249—250).—The smallest trace of chloride can be detected in gelatin if a 10% solution is dried on a glass plate, and a drop of 10% silver nitrate placed thereon. Sodium chloride present to the extent of 0·001% of dry gelatin gives a white ring, 1—2 cm. in diameter, round the drop. The reaction can be used quantitatively if standards are made from chloride solutions and carefully washed gelatin. On exposing the gelatin film so treated to light, the ring turns bluish-, and the colourless space under the drop reddish-yellow. This indicates that silver chloride is present in both, but in a finer state of subdivision in the latter. The author has shown that the thickening ("reifung") of the haloid salts in a gelatin plate is due to excess of halogen, and not to excess of silver. The ring is formed where the diffusing colloidal silver chloride arrives at a region where halogen is in excess. G. S. W.

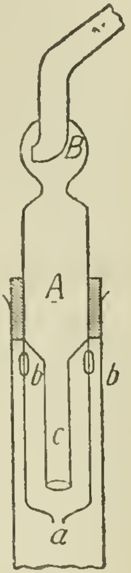
The Presence of Iodate in Commercial Potassium Iodide. Launcelot W. Andrews (*J. Amer. Chem. Soc.*, 1909, 31, 1039—1039).—The author states that the general belief as to the presence of iodate in commercial potassium iodide is not justified, and that if any is present its amount cannot exceed 20 parts per million. The blue colour which some samples give on adding starch paste and dilute hydrochloric acid is not necessarily due to iodate, but may be due to traces of iron oxide or cuprous oxide in presence of dissolved oxygen.

Potassium hydrogen tartrate in solutions free from air does not give the reaction with those impurities, and is therefore preferable to hydrochloric acid. A convenient arrangement for carrying out the test is described. L. de K.

Photo-electric Measurement of Small Ozone Concentrations. Efficiency of Goldstein's Ozonisation Process at Great Dilutions. Wilhelm Hallwachs (*Ann. Physik*, 1909, [iv], 30, 602—606).—It is shown that small quantities of ozone can be estimated photo-electrically by reason of the large specific absorptive power of the gas for ultra-violet radiation of wave-length in the neighbourhood of 258$\mu\mu$. For such measurements the pressure of the gas in the absorption tube should be of the order of 0·01 mm. of mercury. Attempts to prepare ozone from oxygen by Goldstein's process indicated that this process is ineffective at very low pressures. H. M. D.

Bulb Trap for Nitrogen Estimations by the Methods of Kjeldahl and Others. Fr. Dudy (*Chem. Zeit.*, 1909, 33, 1158).—By using the following arrangement, all danger of any alkaline liquid from the distilling flask getting into the standard acid is avoided.

A is a cylindrical tube of a suitable diameter. At *a* it has an opening of 1 mm., and at *b*, one of 5 mm. To the cylinder is sealed the funnel-shaped tube *c*, which has a diameter of about 5 mm. *B* is the usual bulb. On account of the great width of the tube *A*, a wide piece of rubber, not too thin, is used to connect the tube to the distilling flask. L. de K.



Estimation of Total Nitrogen by the Kober Method. F. W. Gill and Harry S. Grindley (*J. Amer. Chem. Soc.*, 1909, 31, 1249—1252. Compare Sebelien, Brynildsen, and Haavardsholm, this vol., ii, 757).—Kober (Abstr., 1908, ii, 776) has described a modification of the Kjeldahl method, in which the ammonia is expelled by adding excess of alkali, and passing a current of purified air through the solution. Experiments have now been carried out which show that the process is well suited to the estimation of nitrogen in organic materials, except when magnesium and phosphorus are both present in comparatively large quantities. In the latter case, the total nitrogen can be accurately estimated if the solutions are kept warm during the passage of the current of air. E. G.

Estimation of Nitrogen in Nitrates and Nitrites. Vincent Schenke (*Chem. Zeit.*, 1909, 33, 1203).—A reply to Mitscherlich (Abstr., 1909, ii, 614). Contrary to Mitscherlich's statement, the author remarks that nitrates may be completely reduced in acid solution. L. de K.

Detection of Nitrates in Presence of Oxidising Substances (Chlorates, Bromates) and Iodides and Bromides. M. Emmanuel Pozzi-Escot (*Ann. Chim. anal.*, 1909, 14, 413—414; *Bull. Assoc. Chim. Sucr. Dist.*, 1909, 27, 367—368).—The solution containing the above salts is introduced into a distilling flask with a large excess of sodium hydroxide. The flask is fitted with a cork, through which passes a large tube bent at right angles. (If ammonium salts should be present, the ammonia should be completely expelled by boiling.) Two or three grams of zinc dust are added, and the whole is boiled gently. The vapours are received in a conical flask containing Nessler solution, and the least trace of nitrates will then be detected by the brown coloration. L. de K.

Irregularities in the Titration of Arsenic after Previous Distillation. Leopold Brandt (*Chem. Zeit.*, 1909, 33, 1114—1115).—The process generally used for the estimation of arsenic in iron ores or steel (conversion into ferric sulphate by evaporation with nitric and sulphuric acids, and distilling the dry mass with fuming hydrochloric acid with addition of ferrous sulphate) is attended with a number of slight errors, which may, however, be readily avoided. No condensing apparatus should be used, but the delivery tube, carrying a bulb and drawn out to a narrow point, dips into a large beaker containing water, which completely absorbs the acid fumes, and, consequently, the arsenic chloride; the beaker is kept cool by being placed in a larger beaker containing cold water. When distillation is finished, the contents of the beaker are neutralised with ammonia free from pyrrole; sodium hydroxide cannot be recommended on account of such frequent impurities as nitrites, chlorates, etc. After adding solution of sodium hydrogen carbonate, the arsenic is titrated with $N/10$-iodine, using 5 c.c. of a 2% freshly prepared starch solution as indicator; starch containing zinc iodide as preservative must not be used, as this causes precipitation of zinc arsenite. Pyrrole-free ammonia may be readily obtained by tinging ammonia with permanganate, and afterwards decanting from the deposit formed. L. DE K.

Electrolytic Detection of Arsenious Oxide in Presence of Arsenic Acid. Ercole Covelli (*Chem. Zeit.*, 1909, 33, 1209).—Thirty c.c. of the liquid to be tested are mixed with excess of potassium hydroxide and placed in a U-tube, into the limbs of which are placed two platinum foils, which are connected with the poles of a Grove cell. In the cathode limb is suspended a strip of paper impregnated with silver nitrate, and if arsenious oxide is present, even in fractions of a mg., a decided brown coloration will be noticed in a time varying from a few minutes to an hour.

Arsenates are not affected. L. DE K.

The Detection of Arsenic Acid in the Presence of Arsenious Acid by means of Magnesia Mixture. Oscar Lutz and R. Swinne (*Zeitsch. anorg. Chem.*, 1909, 64, 298—301).—Arsenious acid has been stated to give a magnesium salt which is not readily separated from the arsenate.

Experiments with solutions of different concentrations show that a qualitative or quantitative separation is not possible, although the precipitation of the arsenite is greatly hindered by the presence of large quantities of ammonium salts. Under these conditions, however, the precipitation of the arsenate also becomes incomplete.

C. H. D.

Analysis of Orpiment. M. Caffin (*Collegium*, 1909, 26, 225—226).—An application of Pearce's method for estimating arsenic in minerals. The substance is fused with potassium nitrate and sodium carbonate, whereby sulphur is oxidised to sulphuric acid and arsenic to alkali arsenate. The solution is made up to a convenient volume, the arsenic precipitated and collected as silver arsenate, redissolved, and titrated with ammonium thiocyanate. Sulphur is estimated as barium sulphate in a different portion of the original solution. F. M. G. M.

Modification of the Reduction Process for Copper Spirals Used in Organic Combustions. Adriano Ostrogovich (*Chem. Zeit.*, 1909, 33, 1187).—The red-hot spirals are introduced quickly into a long tube made of hard Jena glass open at one end. At the bottom is placed a little asbestos, which is moistened with a little methyl alcohol. A perforated cork fitted with a glass tube is inserted, and the tube connected with a pump, which is kept working until the tube has quite cooled down. The spirals will then be found to have been completely reduced. L. DE K.

Replacement of the Platinum Capillaries in the Estimation of Carbon in Iron by the Chromic Acid Method. MAX WIDEMANN (*Chem. Zeit.*, 1909, 33, 1186).—The author dispenses with the platinum capillaries, but uses instead a silica tube 30 cm. long and 10 mm. in diameter, the walls being 1 mm. thick, which is filled with platinum cuttings. The tube is placed on an asbestos felt and heated with a Heinz burner. A complete combustion of any hydrocarbons is thus secured. L. DE K.

Rapid Estimation of Sodium Hydrogen Carbonate in Presence of Sodium Carbonate. BERTHOLD LÖWINGER (*Chem. Zeit.*, 1909, 33, 1174).—A solution of sodium hydroxide is mixed with a little barium chloride to remove any carbonate, and the liquid is then at once standardised with hydrochloric acid, using phenolphthalein as indicator. To the solution to be examined is then added a definite volume of the standardised alkali, and the sodium carbonate formed from the acid carbonate plus that pre-existing is then precipitated by adding barium chloride. The alkalinity is then taken as before and the difference in the titrations represents the sodium hydrogen carbonate. L. DE K.

Estimation of Calcium Oxide in Presence of Calcium Carbonate, etc. HEYER (*Chem. Zeit.*, 1909, 33, 1157—1158).—Calcium oxide may be separated from calcium carbonate by means of a 1% solution of ammonium chloride or nitrate, to 1 litre of which 48 c.c. of ammonia, D 0·910, have been added. If no free ammonia is added, a small portion of the carbonate also dissolves. The results are sufficiently accurate for technical purposes. L. DE K.

Estimation of Magnesium Chloride in Waters. HERMANN EMDE and RICHARD SENST (*Zeitsch. angew. Chem.*, 1909, 22, 2236—2238. Compare Abstr., 1909, ii, 940).—A further series of experiments proving conclusively that, on heating magnesium salts with chlorides at 500—520°, magnesium chloride is formed, and a loss of chlorine consequently takes place. Pfeiffer's method, which is based on the decomposition of pre-existing magnesium chloride by heat, is therefore quite untrustworthy. If heated at a lower temperature, the decomposition of magnesium chloride is incomplete. L. DE K.

Estimation of Zinc as Pyrophosphate. RALPH W. LANGLEY (*J. Amer. Chem. Soc.*, 1909, 31, 1051—1052).—A simplification of the process usually employed. To the zinc solution, which should be made neutral to litmus by means of ammonia, is added an excess of ammonium phosphate. After heating for some time on a steam-bath, the precipitate is collected on a porcelain Gooch crucible, washed five times with cold water, and ignited to constant weight.

L. DE K.

Volumetric Estimation of Lead with Potassium Permanganate. HERMANN BOLLENBACH (*Chem. Zeit.*, 1909, 33, 1142—1143).—A slight modification of the author's previous process.

The lead solution is poured into a hot alkaline solution of potassium permanganate, standardised by means of lead nitrate, and the excess of permanganate is then titrated with the same lead solution (compare Abstr., 1908, ii, 68).

In order to cause the precipitate formed to settle more rapidly, an addition was made of some barium sulphate. This, however, has since proved to be unsatisfactory, and addition of 2 to 5 grams of potassium nitrate is now recommended. L. DE K.

An Application of Graded Potentials to Ore Analysis. DANIEL F. CALHANE and J. C. WOODBURY (*J. Amer. Chem. Soc.*, 1909, 31, 1048—1051).—A process devised for analysis of native lead carbonate, containing also a little silver and copper, besides other impurities. Two grams of the sample are dissolved in nitric acid, and, after neutralising the liquid, 30 c.c. of nitric acid, D 1·42, are added, and the whole is diluted to 250 c.c. Twenty-five c.c. are then taken for analysis by electrolysis.

With an *E.M.F.* of exactly 1·4 volts, the silver is deposited after two hours, and may then be weighed. The electrolysis is then continued overnight at 2 volts, so as to obtain the copper and the lead, which is precipitated as peroxide on the anode. It is very important that the voltage should never exceed 2 during the operation, as otherwise the deposition of the lead peroxide and the copper is incomplete.

L. DE K.

Electrolytic Estimation of Thallium. GILBERT W. MORDEN (*J. Amer. Chem. Soc.*, 1909, 31, 1045—1048).—Thallium may be estimated electrolytically by using a mercury cathode and rotating anode, but it is advisable to use, instead of pure mercury, a very dilute zinc or cadmium amalgam. A stable non-oxidisable thallium amalgam is thus obtained. L. DE K.

Estimation of Cuprous Oxide in Copper and its Alloys. RICHARD HENRY GREAVES (*Chem. News*, 1909, 100, 233—235).—The estimation of cuprous oxide by solution in ammonia as described in the method proposed by Coffetti (this vol., ii, 349) was found to give trustworthy results in the case of pure copper. When arsenic is present, the results are too high, but an approximate correction may be calculated from the amount of arsenic dissolved, on the assumption that it dissolves as arsenate; the same applies to antimony. Commercial copper contains, however, but little, if any, antimony or tin, and errors resulting from the presence of these two metals will be small in practice. The process may be applied to brass and bronze, but, in the case of the latter, the method is not of much use, as the oxygen exists mainly as metastannic acid, and it is this substance which exerts the deleterious influence on the properties of the alloy. The author employs a modification of the apparatus described by Coffetti; instead of a vertical tube, a horizontal one is used. The metal is introduced through a side-tube at the middle of the main tube, this side-tube also serving as the inlet for the ammonia solution after the apparatus has been filled with hydrogen saturated with ammonia. A tube at one end of the main tube serves for the introduction of the hydrogen, whilst one at the other end acts as an outlet for the gas and liquid. W. P. S.

Detection of Mercury in Urine according to Almén. CONRAD STICH (*Pharm. Zeit*, 1909, 54, 833).—In Almén's process the urine is boiled with sodium hydroxide and dextrose, and the precipitate, which contains all the mercury, is then boiled with hydrochloric acid and a piece of copper or brass wire. This, on being heated in a narrow glass tube, gives a sublimate of metallic mercury, which may be recognised as such under the microscope.

The author prefers using very thin pieces of copper foil instead of the wire. These are heated afterwards on the convex part of an object glass, on which is placed another object glass to receive the mercurial sublimate. This may be further identified by placing it over another object glass, on the convex part of which a drop of tincture of iodine has been allowed to evaporate. Soon the mercury is changed to the iodide, which has a characteristic appearance under the microscope. By using "standards," an idea as to the amount of mercury present may be obtained. L. DE K.

Estimation of Iron in Water. KLUT (*Chem. Zentr.*, 1909, ii, 1076—1077; from *Mitt. K. Prüfgs.-Anst. Wasserversorg Abwasserbeseit*, 1909, 12, 174—182).—Five hundred to one thousand c.c. of the sample are concentrated to 150—200 c.c., and boiled with 2—3 c.c. of strong nitric acid. The iron is then precipitated with ammonia, washed, and redissolved in hydrochloric acid. It is estimated colorimetrically by means of ferrocyanide, or, preferably, thiocyanate. The process does not work well with waters charged with peaty matter; in this case, the organic matters must be got rid of by burning.

L. DE K.

Rapid Estimation of Vanadium in Ores and Technical Products. EUGENIO PIÑERÚA ALVAREZ (*Chem. Zeit.*, 1909, 33, 1149).—The finely-powdered material (about 0·5—1 gram) is fused with seven to eight times its weight of pure sodium peroxide for fifteen to twenty minutes at a red heat. When cold, the mass is treated with boiling water and the filtrate acidified with sulphuric acid. Alcohol is then added, and, without taking notice of any precipitate, a current of sulphur dioxide is passed for some time. Any undissolved matter is removed by filtration, and the liquid is freed from alcohol and excess of sulphur dioxide by heating and passing a current of carbon dioxide. If arsenic should be present, this must be removed by means of hydrogen sulphide, and, after boiling the filtrate to expel the excess of that gas, the vanadium is titrated (in a 1% solution) with standard permanganate. This should be checked with a 1% solution of ammonium metavanadate, after first expelling the ammonia with sodium hydroxide and then reducing the solution by boiling with sulphuric acid and sulphur dioxide under similar conditions to those described. L. de K.

Assay of Oil of Turpentine by Bromine; Estimation of Free Bromine by Sodium Formate. Mansier (*Ann. Chim. anal.*, 1909, 14, 417—421).—One c.c. of the sample is placed in a stoppered flask and dissolved in 5 c.c. of chloroform; 50 c.c. of 3% bromine water are then added at once, and the whole is well shaken. More bromine water is added with constant shaking until the last drop causes the chloroform to turn yellow. One c.c. of pure oil of turpentine absorbs 1·69 grams of bromine. If less is required, the presence of petroleum may be suspected and its amount calculated.

A new method is given for checking the bromine solution; 10 c.c. of sodium formate (1·6125 grams per litre) are placed in a flask, and 0·10 gram of precipitated zinc oxide is added. The bromine solution is then run in until the liquid turns yellow. One mol. of sodium formate = 2 atoms of bromine. On account of the action of bromine on zinc oxide and the amount required to colour the water, a correction of 0·018 gram must be applied. L. de K.

[Estimation of Phenol and *p*-Cresol in Urine.] W. Mooser (*Zeitsch. physiol. Chem.*, 1909, 63, 155—200).—See this vol., ii, 1039.

Ultramicroscopical Studies. J. Amann (*Chem. Zentr.*, 1909, ii, 1076; from *Schweiz. Woch. Chem. Pharm.*, 1909, 47, 480—483).—The reduction of Fehling's solution, observed under the ultramicroscope, is a neat and delicate reaction, it being obtainable with a solution containing 0·00001 gram of dextrose per c.c. The Fehling solution of the Swiss Pharmacopœia, which contains glycerol, cannot, however, be used in this case; the formation of osazone by means of phenylhydrazine is also readily observed by means of the instrument.

L. de K.

Clinical Detection of Dextrose in Urine by *o*-Nitrophenylpropiolic Acid. H. Bottu (*Chem Zentr.*, 1909, ii, 1280; from *Bull. Sci. Pharmacol.*, 1909, 16, 399—401).—3·5 Grams of powdered *o*-nitrophenylpropiolic acid are dissolved in 50 c.c. of 10% sodium hydroxide and diluted to 1000 c.c. Eight c.c. of the reagent are mixed in a test-tube with 20—25 drops of urine, and the upper layer is heated to boiling. Another 1 c.c. of urine is then added drop by drop. In the presence of dextrose a blue coloration and precipitate, due to indigotin, will be noticed. If the blue colour appears before the second portion of the urine is added, the amount of dextrose is sure to exceed 1%.

L. de K.

Detection of Biliary Acids, Lævulose, Glycuronic Acid, and Pentoses in Urine. F. Wittels and N. Welwart (*Chem. Zeit.*, 1909, 33, 1133).—An adverse criticism of Jolles's proposed modifications (compare *ibid.*, 1908, 32, 917) of the Ihl-Pechmann's process for the detection of lævulose, of Tollens's glycuronic acid test, and Bial's pentose reaction as applied to urines. The original methods are recommended. L. de K.

Estimation of Carbohydrates in Foods. P. C. den Herder (*Pharm. Weekblad*, 1909, 46. 1306—1312).—In no case should the balance in the analysis of food products be called starch; starch should be estimated in the residue insoluble in cold water by inversion with 2% hydrochloric acid. Sugar should be inverted by Clerget's process, for, if inverted by boiling, a very serious loss (up to 30%) may occur. There is generally a deficit in the full analysis, but this may be checked to some extent by determining the portion soluble in cold water (freed from albumin) and allowing for sugars present; in a well-conducted analyses the residue should be fairly equal to the deficit in the full analysis.

For the separation of dextrin and soluble starch, it is recommended to evaporate the aqueous solution, obtained in due course, to about 10 c.c.; the dextrin, etc., is then precipitated by first adding 40 c.c. of methyl alcohol and then 160 c.c. of 95% ethyl alcohol. The alcoholic solution retains the sugars.

In these kind of analyses, it is advisable first to make a qualitative analysis; the operations may then very often be considerably shortened. L. de K.

Direct Detection of Formaldehyde in Leaves; Formaldehyde Reagents. Thomas Bokorny (*Chem. Zeit.*, 1909, 33, 1141—1142, 1150—1151).—A review of the various reagents proposed for the detection of formaldehyde, and of the attempts made up to the present to apply a direct microchemical test for that substance in leaves in which, according to recent theory, it is supposed to occur as an intermediary compound.

The author remarks that the reagents used are either too caustic or else too poisonous. The leaf, being killed, cannot go on generating formaldehyde, and the quantity already present is too small to be detected with certainty. It is also doubtful whether the distillation process yields better results. L. de K.

Estimation of Formic Acid. Hartwig Franzen and G. Greve (*J. pr. Chem.*, 1909, [ii], 80, 368—389).—Gravimetric methods, based on the reduction of mercuric chloride by formic acid, only yield quantitative results when the hydrochloric acid formed during the reaction is neutralised as the reduction proceeds; if this is done, the amount of mercurous chloride precipitated is equivalent to the quantity of formic acid present. The method is applicable to the estimation of formic acid in very dilute solution if the following details as to procedure are carried out. The formic acid solution, containing from 0·2 to 1·0 gram of the acid per litre, is treated with mercuric chloride dissolved in hot water, the quantity added being fifteen times the amount required by the equation: $HCO_2H + 2HgCl_2 = CO_2 + 2HCl + Hg_2Cl_2$. The mixture is maintained at a temperature of about 100° for thirty minutes, then neutralised by the addition of sodium hydroxide solution, again heated for about thirty minutes, and once more neutralised. The neutralisation is carried to the point where mercuric oxide begins to be precipitated. When the precipitate of mercurous chloride has settled completely, 20 c.c. of concentrated hydrochloric acid are added to re-dissolve the mercuric oxide; the heating is continued for one hour, and the precipitate is then collected on a weighed filter; it is washed with hot water, dried for six to eight hours at 100°, then kept in a vacuum for about fifteen hours over sulphuric acid and potassium hydroxide, and weighed. The weight of the precipitate multiplied by 0.097726 gives the weight of the formic acid present. It is also shown that formic acid may be removed from a solution by steam-distillation in the presence of phosphoric acid. The distillation must be continued until 10 c.c. of the distillate do not require more than half a drop of *N*/10-barium hydroxide solution for neutralisation. W. P. S.

Volumetric Estimation of Thiocyanic Acid with Permanganate; its Application to Volumetric Estimation of Copper. G. Masino (*Chem. Zeit.*, 1909, 33, 1173—1174, 1185—1186).—An investigation of the permanganate process for the estimation of thiocyanic acid and indirect estimation of copper. The author confirms the results obtained by Klason, and by Grossmann and Hölter, which showed that thiocyanic acid is not oxidised quantitatively by permanganate, a residue being left, the amount of which increases with the dilution. If, in order to avoid this, solutions of greater concentration are used, a still greater source of error is introduced, owing to the difficulty of accurately measuring the liquids. In using this process, the standardisations and the actual analysis should, therefore, be carried out under exactly similar conditions. Hydrochloric acid solutions are preferred. L. de K.

Estimation of Salicylates. Atherton Seidell (*J. Amer. Chem. Soc.*, 1809, 31, 1168—1178).—After criticising unfavourably the bromate method of Freyer, and the iodine method of Messinger and Vortmann, the author proposes the following process. The salicylate is added to a known volume of standardised solution of bromine in strong hydrochloric acid, which causes the salicylic acid to be precipitated completely as a dibromo compound, and the excess of bromine is then titrated with standard stannous chloride as usual. L. de K.

Silver Cyanamide. H. Russell Ellis (*Chem. News*, 1909, 100, 154—155).—In Perotti's method for the estimation of cyanamide in sodium cyanamide and in "nitrolime" (Abstr., 1905, ii, 870), any sulphide, cyanide, or chloride which may be present as impurity is thrown down with the cyanamide in the precipitation with silver nitrate, and an incorrect result is obtained.

The author puts forward the following methods: 1. Estimation of cyanamide and cyanide in sodium cyanamide.—From an aqueous solution of the substance, the cyanide is precipitated by excess of silver nitrate in the presence of nitric acid. After washing the precipitate of silver cyanide, it is dissolved in nitric acid, and the silver estimated by titration with ammonium thiocyanate. The filtrate and washings from the silver cyanide are run into a slight excess of ammonium hydroxide solution and the solution warmed. A precipitate of silver cyanamide is obtained; this is dissolved in nitric acid, and the silver estimated by titration. From the silver in each case, the percentage of cyanide and cyanamide can be determined.

2. Estimation of "Nitrolime."—One to two grams of the finely powdered substance are shaken up with water, and filtered into a 500 c.c. flask, the residue being well washed until the filtrate gives no precipitate with ammoniacal silver nitrate solution. An aliquot portion of this solution is precipitated by excess of ammoniacal silver nitrate. The precipitate is well washed with warm water, and then treated with dilute nitric acid (1 : 5), in order to remove all the silver cyanamide.

The silver in the filtrate and washings is then estimated by titration. Any sulphide or chloride of silver remains on the filter paper. Any fluoride present in the cyanamide will not dissolve in water, or if any dissolves, it is not precipitated.

The above methods assume that silver cyanamide has the formula Ag_2CN_2. To verify this, the pure salt was prepared from "nitrolime" and analysed. The percentage of silver was determined (*a*) by heating, and weighing the silver left, (*b*) by dissolving the salt in nitric acid and estimating the silver with ammonium thiocyanate. The results are in agreement with the formula Ag_2CN_2, and not with $AgHCN_2$, although the two methods do not give the same percentage of silver—84·48 in (*a*) and 83·3 in (*b*).

When silver cyanamide is heated, it explodes more or less violently. The gases formed by the explosion were found to be cyanogen and nitrogen. Quantitative estimations indicated that the decomposition occurs in accordance with the equation: $2Ag_2CN_2 = 4Ag + C_2N_2 + N_2$.

T. S. P.

The Detection and Method of Formation of Aromatic Substances in the Organism. I. Detection of Indole and Scatole. Ferdinand Blumenthal, Friedrich Herschmann, and Ernst Jacoby (*Biochem. Zeitsch.*, 1909, 19, 521—533).—The various reactions for the identification of indole and scatole were investigated. The *p*-dimethylaminobenzaldehyde reaction can be employed to distinguish between the two substances if nitrite is added. Scatole on addition of nitrite gives a bluish colour, whereas indole gives a more orange colour. By this reaction indole and scatole can be detected in mixtures. The other reactions investigated were (*a*) the vanillin reaction, which is not suitable for detecting the two substances when both are present; (*b*) the *p*-nitrobenzaldehyde reaction, by means of which both can be detected when scatole is present in relatively high concentration; and (*c*) the protocatechualdehyde reaction, which is not applicable for detection of the mixtures; the heliotropin, the safrole, cinnamaldehyde, eugenol, glyoxylic acid and other reactions were also investigated. S. B. S.

Chemistry of Urine. L. DE JAGER (*Zeitsch. physiol. Chem.*, 1909, 62, 333—346).—This paper treats of two subjects: (1) the boiling test for albumin in urine, and its fallacies, especially in relation to the reaction of the urine, and the precipitability of certain phosphates on heating, and (2) the incorrectness of ammonia estimations by the "formaldehyde method" recently introduced; as others have pointed out, amino-acids also react with the reagent.

W. D. H.

Volumetric Estimation of Caseinogen in Cow's Milk. EDWIN B. HART (*J. Biol. Chem.*, 1909, 6, 445—451).—The caseinogen is precipitated by acetic acid, washed on the filter with cold water, then returned to the flask with the filter, dissolved in *N*/10-potassium hydroxide diluted with water free from carbon dioxide, and titrated with *N*/10-acid, using phenolphthalein as indicator. A correction is made for the acidity of a blank experiment, and the amount of acid used is a measure of the quantity of caseinogen. The whole process occupies less than two hours. W. D. H.

Employment of Hydrogen Peroxide in Investigations on Oxydases. T. KIKKOJI and CARL NEUBERG (*Biochem. Zeitsch.*, 1909, 20, 523—525).—The employment of hydrogen peroxide and iron salts for the detection of oxydases is often resorted to. The authors show that phenol and twenty-five other substances, of which a list is given, yield, in presence of iron salts with the peroxide, dark colours or precipitates. The pigmented substance from phenol was prepared in quantity, and differed from melanins in that it contained 12·60—14·32% iron. S. B. S.

A Reaction for Acid Soils. OSCAR LOEW (*Zeitsch. landw. Versuchswesen Oesterr.*, 1909, 461—463).—The soil (10 grams) is heated on a water-bath for five to ten minutes with 10 c.c. of a 1% solution of potassium iodide. A few drops of a 1% solution of potassium nitrite are added, and then a few drops of starch solution, after which it is quickly cooled.

The blue coloration may sometimes be produced in absence of potassium nitrite with soils containing basic ferric salts (a very intense reaction was obtained with so called colloidal ferric hydroxide which contained basic ferric chloride). The presence of basic ferric sulphate in such soils can be established by extracting several times with boiling water, digesting with ammonia, evaporating the ammoniacal filtrate, and treating with barium chloride and hydrogen chloride. N. H. J. M.

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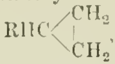
cyclic trimethylene compounds of the type  $RHC<\begin{matrix}CH_2\\ |\\ CH_2\end{matrix}$, A., i, 226.

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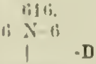
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β-Hydroxybutyrase.
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4-(*p*)-**Toluidino-7-methylcoumarin** (ANSCHÜTZ, WAGNER, and JUNKERSDORF), A., i, 664.

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o- and *m*-**Toluidinomethyleneacetylacetone** (DAINS and BROWN), A., i, 782.

m-**Toluidinomethylenebenzylcyanide** (DAINS and BROWN), A., i, 782.

p-**Toluidino-*d*-methylenecamphor**, rotatory power of (POPE and READ), T., 177 ; P., 19.

4-*o*-**Toluidinomethylene-1:3-diphenyl-5-pyrazolone** (DAINS and BROWN), A., i, 782.

m-**Toluidinomethylenemalonic acid**, ethyl ester, *m*-toluidide of (DAINS and BROWN), A., i, 781.

4-*p*-**Toluidinomethylene-1-phenyl-3-methyl-5-pyrazolone** (DAINS and BROWN), A., i, 782.

Toluidinoperimidine, 2-*o*-, and 2-*p*- (SACHS), A., i, 432.

Tolunaphthazine, new (NOELTING, GRANDMOUGIN, and FREIMANN), A., i, 443.

o-, *m*-, and *p*-**Toluobornylamide** (FRANKLAND and BARROW), T., 2040 ; P., 263.

p-**Toluoylazobenzene** (PONZIO and CHARRIER), A., i, 443.

p-**Toluoylazo-*p*-bromobenzene** (PONZIO and CHARRIER), A., i, 443.

2-*p*-**Toluoylbenzoic acid**, *tri*nitro-, and *tri*amino- (BADISCHE ANILIN- & SODA-FABRIK), A., i, 243.

α-*p*-**Toluoyl-β-*p*-bromophenylhydrazine**, β-nitroso- (GIOVETTI), A., i, 739.

β-*p*-**Toluoyl-α-*p*-bromophenylhydrazine** (PONZIO and CHARRIER), A., i, 443.

m-**Toluoylformic acid**, 6-hydroxy-, and its anil (FRIES and FINCK), A., i, 43.

p-**Toluoylformic acid**, 3-hydroxy- (FRIES and FINCK), A., i, 44.

α-*p*-**Toluoyl-β-*p*-tolylhydrazine**, and β-nitroso- (GIOVETTI), A., i, 738.

o-**Tolyl** camphor-β-sulphonate, and hydrogen camphorate, and rotatory powers of (HILDITCH), T., 338.

m-**Tolyl** glycerol ether, 5-chloro- (EHLOTZKY), A., i, 786.
  mercaptan, 2:4-*di*amino-, and its hydrochloride (SCHULTZ and BEYSCHLAG), A., i, 269.
  methyl ether, 4-nitro-, and 4-amino-, and its acetyl derivative (KHOTINSKY and JACOPSON-JACOPMANN), A., i, 805.

p-**Tolyl** acetate, *o*-benzoylamino- (AUWERS and EISENLOHR), A., i, 916.

(*Tolyl compounds*, *Me* = 1.)

p-**Tolyl** benzoate, *o*-acetylamino-, and its diacetylbenzoyl derivative (AUWERS and EISENLOHR), A., i, 916.
  carbonate, *o*-nitro- (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 299.
  chlorothiolacetate (AUWERS and ARNDT), A., i, 176.
  propionate, *o*-acetylamino- (AUWERS and EISENLOHR), A., i, 916.

Tolyl antimonites, *o*-, *m*-, and *p*- (MACKEY), T., 608 ; P., 98.

p-**Tolylacetoacetic acid**, α-hydroxy-, methyl ester (GUYOT and BADONNEL), A., i, 305.

Tolylacetonitriles, formation of methyl derivatives of 2-phenyl-1:3-naphthylendiamine from the three (BEST and THORPE), T., 261 ; P., 28.

Tolylamino-. See Toluidino-.

s-*p*-**Tolyl*iso*amyloxymethylthiocarbamide** (JOHNSON and GUEST), A., i, 371.

N-*m*- and *p*-**Tolylanisaldoximes** and their hydrogen *tri*-iodides (BECKMANN, EBERT, NETSCHER, and SCHULZ), A., i, 653.

Tolylanthraquinone, 2-chloro-5- and 2-chloro-8-amino- (BADISCHE ANILIN- & SODA-FABRIK), A., i, 940.

Tolylarsinic acids. See under Arsenic.

p-**Tolylauramine**, 2-amino- (GRANDMOUGIN and LANG), A., i, 974.

N-*p*-**Tolylbenzaldoxime** hydrogen *penta*-iodide (?) (BECKMANN, EBERT, NETSCHER, and SCHULZ), A., i, 654.

p-**Tolylbenzylphthalamide** (TINGLE and BRENTON), A., i, 799.

m-**Tolylboric acid**. See under Boron.

o-**Tolyl-*tert*.-butyl alcohol** (CARRÉ), A., i, 544.

m-**Tolyl-*tert*.-butyl alcohol** and its acetyl derivative (CARRÉ), A., i, 544.

p-**Tolylcamphoramic acids**, α- and β-*cis*- and -*trans*- and imides of (ABATI and DE NOTARIS), A., i, 783.

4-*p* **Tolylcinnoline** and its salts (STOERMER and FINCKE), A., i, 843.

β-*p*-**Tolylcrotonic acid** and its ethyl ester, and metallic salts (MATSCHUREVITSCH), A., i, 304.

Tolyldiazohydroxylamino-*p*-toluene, *o*-, *m*-, and *p*-, and bromo-derivatives (GEBHARD and THOMPSON), T., 772, 1117.

5-*o*-**Tolyl-2:4-di-*o*-methylbenzylpyrimidine**, 6-amino- (BEST and THORPE), T., 266.

5-*p*-**Tolyl-2:4-di-*p*-methylbenzylpyrimidine**, 6-amino-, and its hydrochloride (BEST and THORPE), T. 271.

(*Tolyl compounds*, *Me* = 1.)

5-*m*-**Tolyl-2:4-di-*m*-methylbenzylpyrimidine**, 6-amino-, and its hydrochloride (Best and Thorpe), T., 268.
p-**Tolyldimethylpyrazolone**, compound of, with mercuric oxide (Eury), A., i, 57.
p-**Tolyldimethylsulphonium** methyl sulphate (Auwers and Arndt), A., i, 644.
m-**Tolylenediamine**, action of sulphur on (Schultz and Beyschlag), A., i, 269.
s-*p*-**Tolylethoxymethylthiocarbamide** (Johnson and Guest), A., i, 371.
m-**Tolylethyl alcohol**, acetyl derivative of (Carré), A., i, 544.
tert.-*o*-, and -*p*-**Tolylfenchol** (Leroide), A., i, 596.
Tolylidenecamphors, *m*-, and *p*-, preparation of (Haller and Bauer), A., i, 595.
p-**Tolyliodoxyfluoride** hydrofluoride (Weinland and Reischle), A., ii, 37.
p-**Tolylmethylallylcarbinol** (Grishkewitsch-Trochimowsky), A., i, 151.
p-**Tolylmethylethylsulphonium** methyl sulphate (Auwers and Arndt), A., i, 645.
Tolylmethylfurfuraldehyde (Fenton and Robinson), T., 1338.
2-*o*-**Tolyl-1-methyl-Δ^2-*cyclo*hexene** (Murat), A., i, 147.
β-*p*-**Tolyl-α-methylhydracrylic acid** and its ethyl ester, and silver and sodium salts (Strschalkovsky), A., i, 304.
β-*p*-**Tolyl-β-methylhydracrylic acid** (Matschurevitsch), A., i, 304.
  metallic salts (Grishkewitsch-Trochimosky), A., i, 151.
p-**Tolyl methyl ketone** and allyl iodide, action of magnesium on a mixture of (Grishkewitsch-Trochimowsky), A., i, 151.
  and ethyl bromoacetate, action of zinc on admixed (Matschurevitsch), A., i, 304.
6-*o*-**Tolyl-1-methyl-5:7-naphthylenediamine**, and its dihydrochloride and diacetyl derivative (Best and Thorpe), T., 226; P., 29.
6-*m*-**Tolyl-2-methyl-5:7-naphthylenediamine**, and its dihydrochloride and diacetyl derivative (Best and Thorpe), T., 269; P., 29.
7-*p*-**Tolyl-2-methyl-6:8-naphthylenediamine**, and its dihydrochloride and diacetyl derivative (Best and Thorpe), T., 272; P., 29.
p-**Tolyl methyl thioether** (Auwers and Arndt), A., i, 175.
3-*o*-and -*p*-**Tolyl-6-methyl-2-thio-1:2:3:4-tetrahydroquinazoline** (Senier and Shepheard), T., 503.

(*Tolyl compounds*, *Me* = 1.)

s-*p*-**Tolyl-α-naphthylcarbamide** (Senier and Shepheard), T., 502.
N-*p*-**Tolyl-*o*-nitrobenzaldoxime** (Beckmann, Ebert, Netscher, and Schulz), A., i, 654.
β′-*o*-**Tolyloxy*iso*propyl alcohol**, β-amino-, and its salts and benzoyl derivative (Boyd and Knowlton), T., 1804; P., 235.
β-*p*-**Tolylpentane-βδε-triol** (Grishkewitsch-Trochimowsky), A., i, 151.
p-**Tolylphthalamic acid**, benzylamine salt (Tingle and Brenton), A., i, 799.
Tolylphthalamic acids, *m*- and *p*-, and the benzylamine salts of the *m*-acid (Tingle and Roeker), A., i, 29.
m-**Tolylphthalimide** (Tingle and Roeker), A., i, 29.
α-*p*-**Tolylpropaldehyde**, isolation of, from terpinene (Henderson and Cameron), T., 973; P., 151.
m-**Tolyl*iso*propyl alcohol** and its acetyl and benzoyl derivatives (Carré), A., i, 544.
3-*m*-**Tolylquinoxaline**, 2:4′-*di*hydroxy-, (Fries and Finck), A., i, 43.
3-*p*-**Tolylquinoxaline**, 2:3′-*di*hydroxy- (Fries and Finck), A., i, 44.
N-*o*-**Tolylsalicylaldoxime** and its hydrogen tri-iodide (Beckmann, Ebert, Netscher, and Schulz), A., i, 654.
N-*p*-**Tolylsalicylaldoxime** and its hydrogen pentaiodide (Beckmann, Ebert, Netscher, and Schulz), A., i, 653.
o-**Tolylsulphoxyacetic acid**, *p*-chloro-, and its homologues (Kalle & Co.), A., i, 477.
p-**Tolyltartronic acid**, methyl and ethyl esters (Guyot and Esteva), A., i, 237.
p-**Tolylthiocarbamide**, action of methyleneaniline on (Senier and Shepheard), T., 505.
s-**1-Tolylthiocarbamido-1:3:4-triazole** (Bülow), A., i, 681.
p-**Tolylthiolacetic acid** bromide and *di*-bromide (Pummerer), A., i, 580.
Tomatoes, manurial experiments with calcium nitrate on (Stutzer), A., ii, 929.
  preserved, detection of salicylic acid in (Saporetti), A., ii, 101.
Toxic effects of eserine, effect of magnesium on (Joseph), A., ii, 170.
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Train oil, Japanese, solid constituents of (Okada), A., i, 7.

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Trehalose, synthesis of new disaccharides of the type of (Fischer and Delbrück), A., i, 633.

*iso***Trehalose** and its *octa*-acetyl derivative (Fischer and Delbrück), A., i, 633.

Triacetalylamine, preparation of, and its additive salts (Wolff and Marburg), A., i, 15.

Triacetonitrile oxide (Wieland), A., i, 217.

2:4:6-Triacetoxybenzene-1:3-dicarboxylic acid, 5-nitro-, ethyl ester of (Leuchs and Geserick), A., i, 107.

3:1′:4′-Triacetoxy-1-methylbrazan (Grafmann and v. Kostanecki), A., i, 250.

2:6:6-Triacetyl-1:5-diphenyl*cyclo***hexan-3-one** (Ruhemann), T., 114.

Triacetyl*cyclo***hexantrione** and its copper salt, two monophenylhydrazones and oxime (Heller), A., i, 656.

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  derived from new trialkylacetophenones (Haller and Bauer), A., i, 654.

Trialkylacetophenones, new, and trialkylacetic acids from them (Haller and Bauer), A., i, 654.

Triallylcarbinol and its hexabromide (Reformatsky), A., i, 3.

Triamylamine hydrochloride, action of, on ethyl alcohol (van Hove), A., i, 701.

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Triazo-group (Forster), T., 184, 433; P., 25, 69; (Forster and Müller), T., 191, 2072; P., 26, 291.

Triazoacetic acid, its triazoethyl ester, chloride, anilide, and anhydride (Forster and Müller), T., 200.

Triazoantipyrine (4-*triazo*-1-*phenyl*-2:3-*dimethylpyrazolone*) (Forster and Müller), T., 2072; P., 291.

p-**Triazobenzaldoxime** (Forster and Dunn), T., 430.

a-**Triazobutyric acid** and its ethyl ester, silver and brucine salts and amide and the resolution of the brucine salt, ethyl ester and the amide, and *l*- (Forster and Müller), T., 193.

a-**Triazo***iso***butyric acid** and its ethyl ester, silver and potassium salts and amide (Forster and Müller), T., 196.

1:2:5-Triazole, 1-amino-, and its picrate and hydrochloride, and 1-benzoylamino- (v. Pechmann and Bauer), A., i, 271.

1:3:4-Triazole, 1-amino-, action of, on diketones (Bülow and Weber), A., i, 614.
  and its 2:5-substitution products, action of, on methylbromocoumalic acid (Bülow and Weber), A., i, 613.
  the amino-group of, and formylamino-, and its metallic derivatives (Bülow), A., i, 680.
  and its platinichloride, *tetra*chloroplato-compound, aurichloride, and *tri*chloroauro-compound (Pellizzari), A., i, 534.

1(1′:3′:4′)-Triazolyl-2:5-dimethylpyrrole-3:4-dicarboxylic acid and its ammonium and silver salts (Bülow and Weber), A., i, 614.

1-Triazolyl-2:6-lutidone (Bülow and Weber), A., i, 614.

1(1′:3′:4′)-Triazolyl-2-pyridone-5-carboxylic acid, 3-bromo-, methyl ester (Bülow and Weber), A., i, 613.

Triazolyl-pyrrole and **-lutidone** derivatives (Bülow and Weber), A., i, 614.

4-Triazo-1-phenyl-2:3-dimethylpyrazolone. See Triazoantipyrine.

a-**Triazo***iso***valeric acid** and its ethyl ester, silver salt, and amide (Forster and Müller), T., 198.

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Tribenzylmethyl bromide and chloride (Schmerda), A., i, 564.

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Tricinnamylethylammonium chloride, and platinichloride (Emde and Franke), A., i, 708.

αγδ-**Triethoxy-Δ_β-butylene** (Gauthier), A., i, 355.
ααα-**Triethylacetophenone** and its oxime (Haller and Bauer), A., i, 109.
Triethylamine picrate and styphnate, preparation and crystallography of (Jerusalem), T., 1281.
Triethylammonium chloride, double salt of, with silver cyanide (Michael and Hibbert), A., i, 92.
  cyanide (Michael and Hibbert), A., i, 92.
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  behaviour of, in the animal organism (Kohlrausch), A., ii, 918.
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2:4:6-Trimethoxybenzaldehyde and its bispyrazolone derivative (Mundici), A., i, 720.
Trimethoxybenzoincarboxylic acid, hydroxy-, and its lactone (Perkin and Robinson), T., 404.
2 3:4-Trimethoxybenzoyl chloride and cyanide (Mauthner), A., i, 161.
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Trimethoxy-α-brazanquinone (Perkin and Robinson), T., 394.
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αγδ-**Trimethoxy-Δ_β-butylene** (Gauthier), A., i, 355.
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2:3′:4′-Trimethoxydibenzyl-α-carboxylic acid (Czaplicki, v. Kostanecki, and Lampe), A., i, 236.
Trimethoxymagenta and colour base from (Finger), A., i, 518.
3:4:8-Trimethoxyphenanthrene 9 carboxylic acid, 5-bromo-, and its methyl ester (Knorr and Hörlein), A., i, 919.
2:3:4-Trimethoxyphenylglyoxylic acid and its amide (Mauthner), A., i, 161.
2.4:6-Trimethoxyphenyl methoxymethyl ketone (Herzig and Hofmann), A., i, 165.
2:4:5-Trimethoxyphenyl-α-naphthylcarbinol (Széki), A., i, 920.
2 4 5-Trimethoxyphenylpropylcarbinol (Széki), A., i, 920.
2:4:5-Trimethoxyphenyl-*p*-tolylmethyl ether (Széki), A., i, 919.
Trimethoxystilbene, bromonitro- (Knorr and Hörlein), A., i, 919.
2:3′:4′-Trimethoxystilbene-α-carboxylic acid (Czaplicki, v. Kostanecki, and Lampe), A., i, 236.
Trimethylamine, production of hydrocyanic acid from (Voerkelius), A., i, 776.
  detection of, in urine (Takeda), A., ii, 837.
  trihydrochloride, and dihydrobromide (Kaufler and Kunz), A., i, 556.
  styphnate, preparation and crystallography of (Jerusalem), T., 1286.
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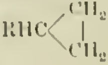
  iridichloride (Gutbier and Lindner), A., ii, 1025.
  tungstate (Ekeley), A., i, 556.
3:2′:4′-Trimethylazobenzene, 6-hydroxy-. See 4-*m*-Xyleneazo-*p*-cresol.
3:5:4′-Trimethylazobenzene, 6-hydroxy-. See *p*-Tolueneazo-4-*m*-xylenol.
5:6:7-Trimethyl-1:2:4:9-benztetrazole (4:5:6-*trimethyl*-2:3:7:0-*diazpyridazine*) (Bülow and Weber), A., i, 615.
Trimethylbrazilone, constitution of (Perkin and Robinson), T., 381; P., 31.
ααβ-**Trimethyl-*n*-butyric acid** and its amide (Haller and Bauer), A., i, 654.
Trimethyl*iso*carbamide and its hydrochloride (McKee), A., i, 636.
3 4:5-Trimethylcarbonatobenzoic acid, ethyl ester (Fischer), A., i, 310.
4 5:6-Trimethyl-2:3:7:0 diazpyridazine. See 5:6:7-Trimethyl-1:2:4:9-benztetrazole.
2′:9:10-Trimethyldihydronaphthacridine (Freund and Bode), A., i, 515.
1:2:2 Trimethyldihydroquinoline and its picrate (Freund and Richard), A., i, 418.
Trimethylene chlorobromide and *di*bromide, preparation of (Bruylants), A., i, 198.
Trimethylene compounds, cyclic, of the type,  $RHC<\begin{matrix}CH_2\\|\\CH_2\end{matrix}$ (Bruylants), A., i, 226.

1:2:4-Trimethyl-4-ethyl-$\Delta^{1:5}$-*cyclo*hexadien-6-ol, 3-cyano-, and its carbonate and benzoyl derivative (Gardner and Haworth), T., 1960.

1:2:4-Trimethyl-4-ethyl-Δ^{1}-*cyclo*hexene-3-carboxylic acid, 6-imino-3-cyano- (Gardner and Haworth), T., 1959.

Trimethylgallic acid, occurrence in nature of, and silver salt of (Power and Moore), T., 254.

βδζ-Trimethylheptan-δ-ol (Bodroux and Taboury), A., i, 546.

1:1:5-Trimethyl-$\Delta^{2:4}$-*cyclo*hexadien-3-ol-6-carboxylic acid, 2:6-*di*cyano-, ethyl ester and its benzoyl derivative (Gardner and Haworth), T., 1958.

2:6:6-Trimethyl*cyclo*hexanecarboxylic acid, 4-amino-, ethyl ester, hydroxide and iodide of (Merling, Welde, Eichwede, and Skita), A., i, 482.

2:6:6-Trimethyl*cyclo*hexane-1-carboxylic acid, 4-chloro-, and 4-bromo-, ethyl esters (Merling, Welde, Eichwede, and Skita), A., i, 481.

1:1:5-Trimethyl-Δ^{4}-*cyclo*hexen-3-one (iso*phorone*) and some of its homologues, synthesis of (Crossley and Gilling), T., 19.
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***p*-Trimethylhydrobenzamide** (Francis), A., i, 589.

3:3:5-Trimethylindolenine-2-formamidoxime (Plancher and Carrasco), A., i, 959.

3:3:5-Trimethylindolenine-2-formonitrile (Plancher and Carrasco), A., i, 959.

βδθ-Trimethylnonan-ζ-one and its oxime (Bodroux and Taboury), A., i, 699, 767.

βδθ-Trimethyl-Δ^{δ}-nonen-ζ-one and its oxime (Bodroux and Taboury), A., i, 699, 767.

1-(1:3:5-)Trimethylphenylmethylbenziminazole, *di*nitrohydroxy- (Meldola and Hay), T., 1047.

Trimethylplatinic chloride iodide, cyanide, hydroxide, nitrate and sulphate, and potassium platinocyanide (Pope and Peachey), T., 571.

2:4:6-Trimethylpyridine, condensation of, with piperonaldehyde, and salicylaldehyde (Bramsch), A., i, 414.
  condensation of, with cinnamaldehyde and anisaldehyde (Proske), A., i, 413.

1:2:6-Trimethylpyridine-3-carboxylic acid, 1:4-thio-, and its ethyl ester and its salts, methiodide, and *tri*oxide, and ammonium salt, methiodide, *tri*oxide and its mercury salt (Michaelis and Heyden), A., i, 529.

1:2:2-Trimethyltetrahydroquinoline and its picrate (Freund and Richard), A., i, 418.

Trimorpholine and its additive salts, and methiodide and methochloride (Wolff and Marburg), A., i, 15.

ααα-Trinaphthylcarbinol *hexa*nitro- and *di*chloro-additive compound (Schmidlin and Massini), A., i, 563.

ααβ-Trinaphthylcarbinol (Schmidlin and Massini), A., i, 563.

Trinaphthylmethane series (Schmidlin and Massini), A., i, 563.

Trioxindole. See Dioxindole, *N*-hydroxy-.

Triphenylacetic acid, salts, preparation of (Gyr), A., ii, 34.
  *di*hydroxy-, morphotrophy of (Rosicky), A., i, 458.

Triphenylarsine oxide. See under Arsenic.

1:3:5-Triphenylbenzene-2′:2″:2‴-tricarboxylic (*phenenyltribenzoic*) **acid,** derivatives of, and methyl ester (Errera and Vaccarino), A., i, 163.

Triphenylcarbamide, *p*-nitro-, 2:4-*di*nitro-, and 2:4:6-*tri*nitro- (Busch, Blume, Pungs, and Fleischmann), A., i, 566.

Triphenylcarbinol, 3:5:3′:5′-*tetra*bromo-*di-p*-hydroxy-, and its methyl ether (Zincke and Wollenberg), A., i, 25.
  *di*amino-, rate of reaction of, with acid and alkali (Sidgwick and Rivett), T., 899; P., 124.

Triphenylcarbinols (Kauffmann and Fritz), A., i, 99.

Tri-α-phenylethane, 3:5:3′:5′-*tetra*bromo-*di-p*-hydroxy- and *di-p*-hydroxy-, and their diacetates (Zincke and Wugk), A., i, 25.

1:2 3-Triphenyl-2-ethyldihydroquinoxaline (Freund and Richard), A., i, 418.

Triphenylguanidine, *o*-hydroxy- (Busch, Blume, Pungs, and Fleischmann), A., i, 566.

Triphenylhydroxyguanidine (Busch, Blume, Pungs, and Fleischmann), A., i, 566.

Triphenylmethane (Straus and Ackermann), A., i, 489; (Straus and Hüssy), A., i, 490.
  hydrogenation of (Godchot) A., i, 19.

Triphenylmethane and distyryl ketone (v. Baeyer), A., i, 641.
  action of nitric acid on (Schwarz), A., i, 561.
  hydrazine derivatives of (Wieland), A., i, 836.
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Triphenylmethane colouring matters, nature of (Schlenk and Knorr), A., i, 807.
  nucleus-substituted (Finger), A., i, 518.
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350	14*	*for*	"lower" *read* "higher."

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Page	Line		
703	22*	*for*	"$KNa_3(SO_4)_2$" *read* "$K_3Na(SO_4)_2$."
703	21*	,,	"lamina" *read* "section."
971	18	,,	"resinous" *read* "single."
971	21	,,	"vitreous" *read* "resinous."

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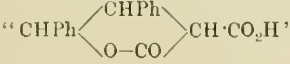
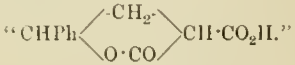
Page	Line		
360	16	*for*	"1-iodothiophen" *read* "2-iodothiophen."
422	2*	,,	 "$\mathrm{CHPh}<\substack{\mathrm{CHPh}\\ \mathrm{O-CO}}>\mathrm{CH\cdot CO_2H}$" *read*  "$\mathrm{CHPh}<\substack{\mathrm{CH_2\cdot}\\ \mathrm{O\cdot CO}}>\mathrm{CH\cdot CO_2H}$."

PART II.

Page	Line		
96	11	*for*	"1907" *read* "1908."
394	4*	,,	"Ramanian" *read* "Roumanian."
401	9*	,,	"Wittmanstedtian" *read* "Widmanstätten."
603	4—5*	,,	"Paramontmorillite" *read* "Paramontmorillonite."
603	1*	,,	"$H_3Mg_2Si_3O_{12}$" *read* "$H_8Mg_2Si_3O_{12}$."
861	17*	,,	"Marcassite" *read* "Marcasite."

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PART I.

Page	Line		
140	12	*for*	"**δ-Aminocaproic**" *read* "**ε-Aminocaproic.**"
144	9*	,,	"**XVIII**" *read* "**XVII.**"
154	4	,,	"*β-Chloro-α-hydroxy-α*(3:4)-*dioxyphenylpropane*" read "*β-Chloro-α*:3:4-*trihydroxyphenylpropane.*"
176	11*	,,	"1905" *read* "1906."
178	22*	,,	"$C_9H_8NCl,6HgCl_2$" *read* "$C_9H_{18}NCl,6HgCl_2$."
182	22*	,,	"**2-Methyl-6-methylolpyridine**" *read* "**2-Methyl-6-ethylolpyridine.**"
273	18*	,,	"sodium" *read* "solution."
286	3	,,	"283" *read* "383."
302	22*	,,	"Abstr., 1908" *read* "this vol."
303	16*	,,	"benzoyl-*d*-aminovaleric" *read* "benzoyl-δ-aminovaleric."
306	17	,,	"*Methyl di*-p-*methoxymalonate*" read "*Methyl di*-p-*methoxyphenylmalonate.*"
469	14*	,,	"**2:6-Dichloro-4-sulphonic acid**" *read* "**2:6-Dichlorophenol-4-sulphonic acid.**"
512	23	,,	"phenylcarbimide" read "phenylthiocarbimide."
517	22	,,	"*aminodihydroxydiphenyl*" read "*aminodihydroxydiphenylamine.*"

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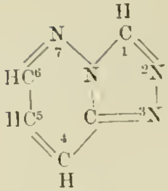
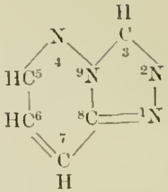
* From bottom.

ERRATA (*continued*).

Page	Line	
614	9*	*for* “” *read* “”
614	8*	,, “4:6-*Dimethyl*-2:3:7:0-*diazpyridazine*” read “5:7-*Dimethyl*-1:2:4:9-*benztetrazole*.”
615	3	,, “4:5:6-*Trimethyl*-2:3:7:0-*diazpyridazine*” read “5:6:7-*Trimethyl*-1:2:4:9-*benztetrazole*.”
615	7, 8	,, “4-*phenyl*-6-*methyl*-2:3:7:0-*diazpyridazine*” read “7-*phenyl*-5-*methyl*-1:2:4:9-*benztetrazole*.”
615	21	,, “4-*Hydroxy*-6-*methyl*-2:3:7:0-*diazpyridazine*” read “7-*Hydroxy*-5-*methyl*-1:2:4:9-*benztetrazole*.”
615	11*	,, “4-*Hydroxy*-5:6-*dimethyl*-2:3:7:0-*diazpyridazine*” read “7-*Hydroxy*-5:6-*dimethyl*-1:2:4:9-*benztetrazole*.”
615	4*	,, “4-*Hydroxy*-6-*phenyl*-2:3:7:0-*diazpyridazine*” read “7-*Hydroxy*-5-*phenyl*-1:2:4:9-*benztetrazole*.”
616	7	,, “hydroxyphenyldiazpyridazine” *read* “hydroxyphenylbenztetrazole.”
826	3	,, “**the Ester of**” *read* “**Ethyl.**”

PART II.

18	26* 25*	*for* “depression” *read* “molecular weight.”
18	21* 14*	,, “less” *read* “more.”
42	21*	,, “**up**” *read* “**on.**”
62	19*	,, “sperulites” *read* “spherulites.”
153	20	,, “Nordhäusen” *read* “Nordhausen.”
154	19*	,, “Katapleite” *read* “Catapleite.”
166	8	,, “P. A. KOHN” *read* “PHILIP H. KOBER.”
170	18*	,, “banana” *read* “pine apple.”
170	10*	
171	1	
370	3	,, “**Form**” *read* “**Force.**”
427	7*	,, “994” *read* “904.”
434	17	,, “perchromates” *read* “perchlorates.”
527	3*	,, “GEORGES” *read* “GABRIEL.”
680	25	,, “1908” *read* “1909.”
681	11*	,, “**Fats**” *read* “**Fate.**”
688	20	,, “578” *read* “518.”
828	20	*delete* “Ruppin.”
835	20	*for* “RIESER” *read* “RIESSER.”
869	2	,, “Holmberg” *read* “Holmgren.”
869	5	
869	9	
913	6*	,, “1503” *read* “503.”

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1069	col. i, line 14	*for* “**Barnett**, *Theo. C.*” read “**Burnett**, *Theo. C.*”
1089	,, i, ,, 1	,, “**Davis**” *read* “**Davies.**”
1128	,, i, ,, 7	,,

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1059	10	i	*for* "**Köffler**" *read* "**Löffler.**"
1068	10*	i	*insert* "an attempt to synthesise collidine, A., i, 440."
1074	2	ii	*for* "**Mayer**" *read* "**Meyer.**"
1076	10	ii	*insert* "reversible reactions of the first order, A., ii, 753."

VOL. XCIII (TRANS., 1908).

2191	10	*for* "$\frac{W'.K_2}{K'_2.W}$" *read* "$I.\frac{W'.K_2}{K'_2.W}$."
2192	4	*after* "$\bar{H}$" *insert* "=."
2195	34	*for* "$\frac{K_2}{K'_2}M$" *read* "$\frac{K_2}{K'_2}M'$."
2197	13	,, "S'" and "W'" *read* "S''" and "W''."
2197	18	,, "$\frac{d^2(H^2)}{dA^2}$" *read* "$\frac{1}{2}\frac{d^2(H^2)}{dA^2}$."
2197	19	*delete* "providing . . . . very great."
2197	20	
2198	15	*for* "acid" *read* "acids."
2198	40	*after* "resembled" *insert* "the effect of water on catalysed."
2198	41	*delete* "by experiment."
2201	7	,, "hydroxonium."
2203	3	*before* "value" *insert* "apparent" *and delete* "$\frac{\Phi}{\phi}$."

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345	16*	*for* "GIALDINO" *read* "GIALDINI."
591	5*	,, "KUHN" *read* "KAHN."
692	21*	,, "VIII" *read* "XXIX."
931	22	,, "X" *read* "XXXIV.".
1017	19	,, "not" *read* "now."

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124	21	*for* "190" *read* "1907."
1058	2*	,, "ALLARET" *read* "ALLARD."

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Page	Line	
360	16	*for* "1-iodothiophen" *read* "2-iodothiophen."

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Part II.

Page	Line	
42	21*	*for* "up" *read* "on."

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PART II.

Page	Line	
350	14*	*for* "lower" *read* "higher."

VOL. XCII (ABSTR., 1907).

PART II.

703	22*	*for* "$KNa_3(SO_4)_2$" *read* "$K_3Na(SO_4)_2$."
703	21*	,, "lamina" *read* "section."
971	18	,, "resinous" *read* "single."
971	21	,, "vitreous" *read* "resinous."

VOL. XCIV (ABSTR., 1908).

PART II.

394	4*	*for* "Kamanian" *read* "Roumanian."
401	9*	,, "Wittmanstedtian" *read* "Widmanstatten."
603	4—5*	,, "Paramontmorillite" *read* "Paramontmorillonite."
603	1*	,, "$H_3Mg_2Si_3O_{12}$" *read* "$H_8Mg_2Si_3O_{12}$."
861	17*	,, "Marcassite" *read* "Marcasite."

VOL. XCVI (ABSTR., 1909).

PART II.

18	26* 25*	*for* "depression" *read* "molecular weight."
18	21* 14*	,, "less" *read* "more."
62	19*	,, "sperulites" *read* "spherulites."
154	19*	,, "Katapleite" *read* "Catapleite."

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* From bottom.

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Vol. XCV (Trans., 1909).

Page	Line		
116	14		in formula *for* "$CO{\cdot}C_6H_5$" *read* "$CO{\cdot}CH_3$."
427	7		*for* "*Y* for *H*" *read* "*Y* for *OH*."
721	6		,, "α-, β-," *read* "αβ-."
722	4*		,, "OH·Hg·OEt" *read* "OH·Hg·Et."
723	11		*delete* "in."
732	1	col. 7	*insert* "– – –."
732	22	col. 6	*for* "– –" *read* "– – –."

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153	20	*for* "Nordhäusen" *read* "Nordhausen."
154	19*	,, "Katapleite" *read* "Catapleiite."
170	18*	,, "banana" *read* "pine apple."
170	10*	
171	1	
419	17	,, "*canaliclatus*" read "*canaliculatus*."

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PART I.

Page	Line	
273	18*	*for* "sodium" *read* "solution."
286	3	,, "283" *read* "383."
302	22*	,, "Abstr., 1908" *read* "this vol."
303	16*	,, "benzoyl-*d*-aminovaleric" *read* "benzoyl-δ-aminovaleric."

PART II.

Page	Line	
370	3	*for* "**Form**" *read* "**Force.**"
427	7*	,, "994" *read* "904."
434	17	,, "perchromates" *read* "perchlorates."

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* From bottom.

Starck, G., ii, 761.
Stark, J., and F. Fischer, ii, 718.
Steinbrenck. A. See P. Jacobson.
Stern, E., ii, 733.
Stern, Mlle. L. See F. Battelli.
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Stock, A., and H. Heynemann, ii, 720.
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Strong, W. W., ii, 715.
Svedberg, T., ii, 723.
Swett, O. D., ii, 755.
Szilard, B., ii, 715, 716.

T.

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Tanret, G., i, 634.
Tatlock, C. S., ii, 766.
Terroine, E. See L. Morel.
Thorpe, J. F. See S. R. Best.
Tibbals. jun., C. A., ii, 728.
Traube-Mengarini, M. and A. Scala, ii, 731.
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Vaubel, W., ii, 769.
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Virgin, E. See O. Widman.
Vlahuta, E. See A. Bacovescu.
Voldere, G. De, and G. De Smet, ii, 755.

W.

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Wagner, J. See R. Anschütz.
Warcollier. See Maurain.
Watteville, C. de. See A. de Gramont.
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Widman, O., and E. Virgin, i, 656.
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Zumbusch, E. See R. Vanino.

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1354	2*	*for* "20" *read* "40."

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Y.

Yamakawa, M. See U. Suzuki.
Yokoyama, H., ii, 926.
Yoshida, Y. See K. Asō.
Yoshikawa, J. See T. Saito.
Yoshimura, K., ii, 928.
Yoshimura, K. See also U. Suzuki.
Young, W. J. See A. Harden.

Z.

Zellner, J., ii, 922.
Zemplén, G. See E. Fischer.
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Zimányi, K., ii, 900.
Zincke, T., and P. Jörg, i, 789.

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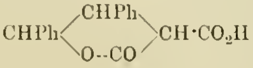
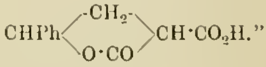
Page	Line	
422	2*	*for* "CHPh<CHPh, O--CO>CH·CO₂H" *read* "CHPh<CH₂, O·CO>CH·CO₂H."



$\mathrm{CHPh}\!<\!\substack{\mathrm{CHPh}\\ \mathrm{O{-}{-}CO}}\!>\!\mathrm{CH{\cdot}CO_2H}$



$\mathrm{CHPh}\!<\!\substack{\mathrm{{\cdot}CH_2{\cdot}}\\ \mathrm{O{\cdot}CO}}\!>\!\mathrm{CH{\cdot}CO_2H}$

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Part I.

306	17	for "*Methyl di*-p-*methoxymalonate*" read "*Methyl di*-p-*methoxyphenylmalonate*."
469	14*	,, "2 : 6-**Dichloro-4-sulphonic acid**" *read* "2 : 6-**Dichlorophenol-4-sulphonic acid**."
512	23	,, "phenylcarbimide" *read* "phenylthiocarbimide."
517	22	,, "*aminodihydroxydiphenyl*" read "*aminodihydroxydiphenylamine*."

Part II.

680	25	*for* "1908" *read* "1909."
684	11*	,, "**Fats**" ,, "**Fate**."
688	20	,, "578" ,, "518."
835	20	,, "Rieser" *read* "Riesser."

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* From bottom.

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Ziersch, P., i, 961.
Zunz, E., ii, 976.

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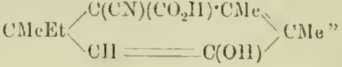
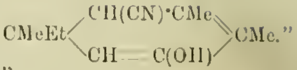
Page	Line	
1951	5	*for* "phototropic" *read* "thermotropic."
1957	24	*omit* "-3-carboxylic acid."
1957	25	*for* " $\mathrm{CMeEt}{<}\begin{matrix}\mathrm{C(CN)(CO_2H)\cdot CMe}\\ \mathrm{CH{=}C(OH)}\end{matrix}{>}\mathrm{CMe}$"
		read " $\mathrm{CMeEt}{<}\begin{matrix}\mathrm{CH(CN)\cdot CMe}\\ \mathrm{CH{-}C(OH)}\end{matrix}{>}\mathrm{CMe}$."
1958	13	,, "acid" *read* "ester."
1960	7*	,, "hydroxy-acid" ,, "dihydrophenol."

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Part I.

144	9*	*for* "**XVIII**" *read* "**XVII.**"
826	3	,, "**the Ester of**" ,, "**Ethyl.**"

Part II.

828	20	*delete* "Ruppin."
869	2	*for* "Holmberg" *read* "Holmgren."
869	5	
869	9	
913	6*	,, "1503" *read* "503."

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